APPENDIX E BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

NEOEN

Biodiversity Development Assessment Report

CULCAIRN SOLAR FARM

NOVEMBER 2019

ngh environmental

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NGH Environmental Pty Ltd (ACN: 124 444 622. ABN: 31 124 444 622)

www.nghenvironmental.com.au e: ngh@nghenvironmental.com.au

Sydney Region
18/21 mary st
surry hills nsw 2010 (t 02 8202 8333)

Canberra - NSW SE & ACT
8/27 yallourn st (po box 62)
fyshwick act 2609 (t 02 6280 5053)

Bega - ACT and South East NSW
suite 1, 216 carp st (po box 470)
bega nsw 2550 (t 02 6492 8333)

Newcastle - Hunter and North Coast
1/54 hudson st
hamilton nsw 2303 (t 02 4929 2301)

Wagga Wagga - Riverina and Western NSW
suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 (t 02 6971 9696)

Brisbane
suite 4, level 5, 87 wickham terrace
spring hill qld 4000 (t 07 3129 7633)

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ACRONYMS AND ABBREVIATIONS

BAM	Biodiversity Assessment Methodology
BC Act	Biodiversity Conservation Act 2016 (NSW)
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	Biosecurity Act 2015
BOM	Australian Bureau of Meteorology
CEEC	Critically endangered ecological communities
CEMP	Construction environmental management plan
Cwth	Commonwealth
DBH	Diameter at Breast Height
EEC	Endangered ecological community
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cwth)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
FM	Fisheries Management Act 1994 (NSW)
GHG	Greenhouse gases
ha	Hectares
HBT	Hollow-bearing trees
IBRA	Interim Biogeographic Regionalisation of Australia
ISEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
km	Kilometres
LEP	Local Environment Plan
LRET	Large-scale renewable energy target
m	Metres
MNES	Matters of National environmental significance under the EPBC Act (c.f.)
MW	Megawatt
NSW	New South Wales
OEH	(NSW) formerly Office of Environment and Heritage, now Biodiversity Conservation Division, Department Planning, Industry & Environment
PV	Photovoltaic
SAII	Serious and Irreversible Impact
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)

sp/spp	Species/multiple species
SSD	State Significant Development
TEC	Threatened Ecological Community
VIS	Vegetation Integrity Score

EXECUTIVE SUMMARY

NGH Consulting has prepared this BDAR on behalf of NEOEN for the Culcairn Solar Farm, 4.3 km northeast of Culcairn, NSW. The proposal would develop around 1126 ha hectares (ha) of the 1367 ha development site.

The aim of this BDAR is to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) and to address the requirements of the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act). This BDAR forms part of an Environmental Impact Statement (EIS) for the State Significant Development (SSD), prepared under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Biodiversity Assessment Methodology (BAM) is the required assessment methodology for SSDs that trigger the NSW Biodiversity Offsets Scheme under the BC Act. This report follows the field work methodologies and assessment required by the BAM.

Comprehensive mapping and field surveys were completed in accordance with the requirements of the BAM. The majority of the development site has been cleared of native vegetation, and cultivated for agriculture, which is the dominant land use in the area. Approximately 1297 ha of the development site is comprised of exotic vegetation in the form of exotic pastures and crops. Around 70 ha of native vegetation occurs in the development site, comprised of scattered isolated patches of remnant woodland, paddock trees and derived grassland. The native vegetation is comprised of four Plant Community Types (PCTS). These are;

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.
- PCT 74 - Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion.
- PCT 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.

PCT 76 is listed as Endangered under the BC Act as it forms part of the TEC - Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion.

PCT 74 and PCT 277 form part of the Endangered Ecological Community (EEC): White Box-Yellow Box-Blakely's Red Gum woodland under the BC Act. These communities within the development site do not meet the criteria for the federally listed CEEC, due to having a very degraded understory dominated by exotic annual grasses.

Consideration has been given to avoiding and minimising impacts to native vegetation throughout each phase of the proposal. Site design options have been assessed against key environmental, social and economic criteria. Larger patches of remnant woodland and creek lines have been avoided by the development footprint. Mitigation and management measures would be put in place to adequately address impacts associated with the proposal, both direct and indirect.

For biodiversity impacts that are unavoidable, the proposal would require the removal of:

- 0.61 ha of PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion

The removal of this native vegetation generated the following ecosystem credits;

- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – 12 credits.

No other PCTs were impacted as a result of the proposal.

The removal of 99 paddock trees generated the following credits:

- PCT 76 – Western Grey Box tall grassy woodland – 18 credits.
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland - 74 credits.

No threatened species were detected during surveys of the Development Site.

Targeted surveys were undertaken for 33 candidate credit species. No species credit species were identified within the development site. Four other species were unable to be surveyed for during the appropriate survey period and were assumed to be present within suitable habitat.

The removal of suitable habitat relating to these threatened species credit species generated the following species credits.

- Small Scurf-pea *Cullen parvum* (Assumed presence) – 10 credits.
- Small Purple-pea *Swainsona recta* (Assumed presence) – 10 credits.
- Silky Swainson-pea *Swainsona sericea* (Assumed presence) – 10 credits.

The retirement of the credits generated will be carried out in accordance with the NSW Biodiversity Offsets Scheme under the BC Act. With the retirement of credits and effective implementation of the mitigation measures, the proposal would be consistent with the requirements of the BAM.

1 INTRODUCTION

The Culcairn Solar Farm proposal is classified as State Significant Development (SSD) under the State and Regional Development State Environmental Planning Policy (SEPP) and therefore a 'major project'. This Biodiversity Development Assessment Report (BDAR) assesses the impacts of the proposed Culcairn Solar Farm (the proposal) according to the NSW Biodiversity Assessment Methodology (BAM) as required by the Secretary's Environmental Assessment Requirements (SEARs) for the proposal. NGH Environmental has prepared this report on behalf of the proponent, Neoen Australia Pty Ltd.

The following terms are used in this document:

- **Development footprint** – The area of land that is directly impacted on by the proposal. Including, solar array design, perimeter fence, access roads, transmission line footprint and areas used to store construction materials. The development footprint is approximately 1126 ha.
- **Development site** – The area of land that is subject to a proposed development, including public road and intersection upgrades. The development site is approximately 1367 ha. The development site is the area surveyed for this assessment.
- **Subject land** – All land within the affected lot boundaries. The area of the subject Land is 1351 ha.
- **Buffer area** – All land within 1500 m of the outside edge of the boundary of the development footprint.

1.1 THE PROPOSAL

Culcairn Solar Farm would occupy around 1125 hectares (ha) of the 1351 ha subject land, retaining existing viable native vegetation remnants that occur on the array site. The proposal would comprise the installation of a solar plant that would generate a maximum 350 MW of renewable energy for the national grid, enough to power approximately 140,000 homes in the Greater Hume area.

The proposal would consist of the following components:

- Single axis tracker photovoltaic solar panels mounted on steel frames over most of the site.
- Battery storage to store energy produced on site (100 MWh capacity).
- Underground and overground electrical conduits and cabling to connect the arrays and to the inverters and transformers.
- Systems of invertor units and voltage step-up throughout the arrays.
- On site substation, connecting to existing 330 kV TransGrid transmission line.
- Site office and maintenance building, vehicle parking areas, internal access tracks and perimeter security fencing.
- Site access track off Cummings Road (both sides of Cummings Road) and unnamed Crown and local roads that cross the site.
- Road crossing and easement electrical crossing through underground and/or overhead lines.

In total, the construction phase of the proposal is expected to take 12 to 18 months. The Culcairn Solar Farm is expected to operate for around 30 years. Approximately 5 to 10 operations and maintenance personnel would operate the plant. The solar farm would be decommissioned at the end of its operational life; all above ground infrastructure and below ground infrastructure less than 2500 mm deep would be

removed in consultation with the landowner, with the site to be returned to its existing land capability for agricultural land use.

1.2 THE DEVELOPMENT SITE

1.2.1 Site location

The proposed location of Culcairn Solar Farm is in the Greater Hume Local Government Area (LGA), around 35 km north of Albury as shown in

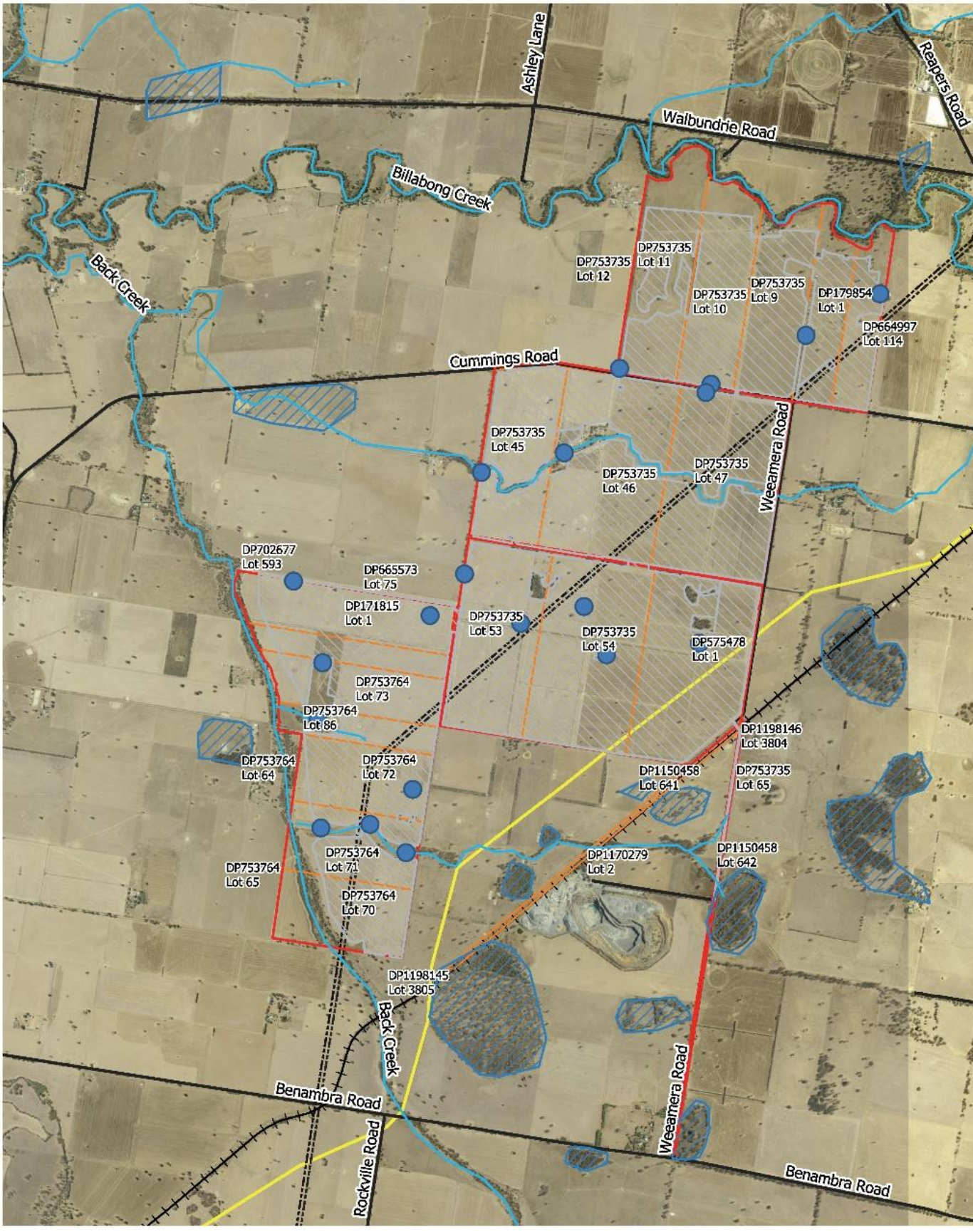
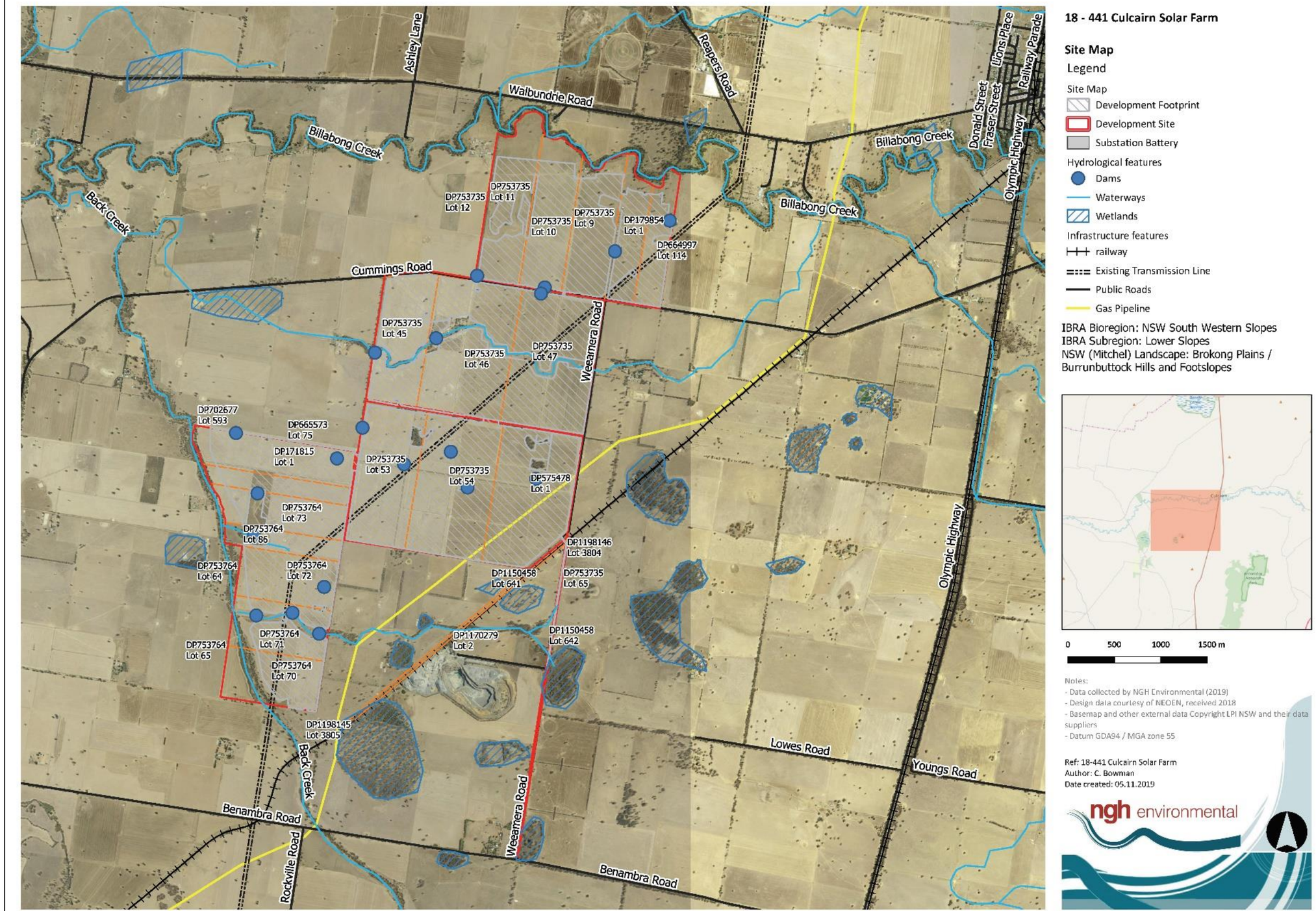


Figure 1-1. The subject land comprises Lots 70-73, 86 DP 753764; Lots 9-11, 45-47, 53, 54 DP 753735; Lot 1 DP 179854; Lot 114 DP 664997; Lot 1 DP 575478; Lot 1 DP 171815; Lot 1 DP 945904; Lot B DP 9720541069452 as shown in Figure 1-1**Error! Reference source not found.**.



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Site Map

Legend

Site Map
- Development Footprint
- Development Site
- Substation Battery

Hydrological features
- Dams
- Waterways
- Wetlands

Infrastructure features
- railway
- Existing Transmission Line
- Public Roads
- Gas Pipeline

IBRA Bioregion: NSW South Western Slopes
IBRA Subregion: Lower Slopes
NSW (Mitchel) Landscape: Brokong Plains / Burrunbuttock Hills and Footslopes

0 500 1000 1500 m

Notes:
- Data collected by NGH Environmental (2019)
- Design data courtesy of NEOEN, received 2018
- Basemap and other external data Copyright LPI NSW and their data suppliers
- Datum GDA94 / MGA zone 55

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Author: C. Bowman
Date created: 05.11.2019

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Figure 1-1 Site map of the proposed Culcairn Solar Farm.

1.2.2 Site description

The development site is located within the Greater Hume Local Government Area (LGA). It is accessed primarily from Cummings Road, approximately 4 km west of the intersection with the Olympic Highway, with alternative access points off Weeamera Road. Cummings Road and Weeamera Road are both local roads managed and maintained by Greater Hume Shire Council. An existing quarry is located on Weeamera Road, and the intersection of Benambra Road and Cummings Road has already been upgraded to facilitate turning heavy vehicles.

The development site is agricultural land comprising several large paddocks that are generally flat and largely cleared and cultivated primarily for cropping. Native vegetation remains in the form of scattered paddock trees, roadside vegetation, riparian vegetation, and small isolated patches of remnant woodland. Three watercourses run through or along the boundary of the development site, Billabong Creek to the north, Back Creek to the west, and three unnamed ephemeral drainage lines flowing east-west through the development site. Billabong Creek holds water and/or is generally flowing all year round. Back Creek and the small unnamed drainage lines are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creek lines are bordered by planted and remnant native vegetation.

Culcairn is the closest town to the proposal, approximately 4.7 km north-west of the proposal. Culcairn is located approximately 50 km north of the major town of Albury, with a population of 1,473 as at the 2016 Census (ABS 2018b). Culcairn has a number of attractions including the Station House Museum, Morgan's Lookout, Culcairn Bike Track, Culcairn Golf Club, and Culcairn Hotel. The population for Albury's urban locality in June 2018 was recorded as 53,289 persons (Population Australia 2018). It supports supermarkets, post offices, service stations, accommodation, restaurants, medical services and recreation facilities.

The Murray River and Lake Hume are located approximately 45 km south and 22 km south-east, respectively, of the proposal. The Benambra National Park and Tabletop Nature Reserve are located approximately 10 km east and 15 km south-east, respectively, of the proposed.

The proposal is within the South Western Slopes Bioregion and the main vegetation types identified in this bioregion are open woodlands of White Box Grassy Woodlands, Grey Box tall grassy woodland, Blakely's Red Gum – Yellow Box grassy tall woodland, and River Red Gum open forest wetlands.

1.3 STUDY AIMS

This BDAR has been prepared by NGH Environmental on behalf of Neoen Australia.

The aim of this BDAR is to address the requirements of the BAM, as required in the SEARs and summarised below.

Secretary's Environmental Assessment Requirement	Where addressed
The EIS must address the following specific issues: Biodiversity impacts related to the proposed development are to be assessed in accordance with section 7.9 of the *Biodiversity Conservation Act 2016* using the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless OEH and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values.	**Sections 2, 3 and 4**
The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.	**Sections 6, 7 and 8**
The BDAR must include details of the measures proposed to address the offset obligation as follows; a. The total number and classes of biodiversity credits required to be retired for the development/project; b. The number and classes of like-for-like biodiversity credits proposed to be retired; c. The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; d. Any proposal to fund a biodiversity conservation action; e. Any proposal to make a payment to the Biodiversity Conservation Fund. If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits	**Section 10**
The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM: • Location of biodiversity development site • Biodiversity development site boundary map • Cadastral map of biodiversity development site • Table of PCTs at the biodiversity development site and the number of ecosystem credits created • Table of threatened species at the biodiversity development site and the number of species credits created • Submitted proposal in the Credit Calculator	**Figure 1-1**Error! Reference source not found. **Figure 1-1** **Section 10.1.1** **Section 10.1.3**
The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the BC Act 2016.	**Document verification (front of document)**

No specific considerations for any threatened species, populations or communities were specified in the SEARs or by the NSW Office of Environment and Heritage (OEH).

1.4 SOURCE OF INFORMATION USED IN THE ASSESSMENT

The following information sources were used in this BDAR:

- Proposal layers, construction methodology and concept designs provided by EB Pro Pty Ltd.
- Australian Government's Species Profiles and Threats (SPRAT) database http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
- DPI profiles of threatened species, population, and ecological communities
- Commonwealth Department of Environment and Energy Protected Matters Search Tool

  Accessed online at http://environment.gov.au/epbc/protected-matters-search-tool
- Australia's IBRA Bioregions and Sub-bioregions. Accessed http://environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2
- NSW OEH's Biodiversity Assessment Method (BAM) calculator (http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx)
- NSW OEH's BioNet threatened biodiversity database

  Accessed online via login at http://www.bionet.nsw.gov.au/
- NSW OEH Threatened Species Profiles

  http://www.environment.nsw.gov.au/threatenedSpeciesApp/ and

  www.environment.nsw.gov.au/AtlasApp/UI_Modules/
- OEH BioNet Vegetation Classification Database (OEH 2017)

  Accessed online via login at http://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx
- OEH VIS Mapping

  Accessed online at http://www.environment.nsw.gov.au/research/VISmap.htm
- Office of Environment and Heritage (OEH) (2017). Biodiversity Assessment Method
- NSW Government SEED Mapping

  https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU
- NSW Biodiversity Values Map
  https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap

2 LANDSCAPE FEATURES

2.1 IBRA BIOREGIONS AND SUBREGIONS

Interim Biogeographic regionalisation for Australia (IBRA) Bioregions are geographically distinct bioregions based on common climates, geology, landforms and native vegetation (Thackaway and Creswell, 1995) There are 89 IBRA bioregions within Australia. The development site falls within the NSW South Western Slopes IBRA Bioregion. The South Western Slopes is an extensive area of foothills and isolated ranges, comprising the lower inland slopes of the Great Dividing Range extending from north of Cowra through southern NSW into western Victoria. The NSW portion of the bioregion occupies about 10.1% of the state. Towns located in the bioregion include Cootamundra, Mudgee, Gundagai, Narrandera, Parkes, Wagga Wagga and Young.

The Lower Slopes Subregion is characterised by wide valleys of the Riverina alluvial fans containing isolated peaks and undulating hilly ranges. The geology of the Lower Slopes comprises Ordovican to Devonian faulted sedimentary rocks imbedded with large areas of intrusive granites.

The Lower Slopes also contains large areas of Tertiary and Quaternary alluvium deposits. Vegetation communities within the subregion occupy suitable landscapes, such as:

- White Cypress Pine on the ranges.
- Poplar Box, Kurrajong, Wilga and Red Box in the north.
- Grey Box woodlands with Yellow Box, White Cypress Pine and Belah on lower areas.
- Myall, Rosewood and Yarran on grey clays.
- Dwyer's Gum on granite.
- Red Ironbark on sedimentary rocks.
- River Red Gum on all streams with Black Box in the west.

2.2 NATIVE VEGETATION

An assessment of native vegetation in the 1500 m buffer area was undertaken using aerial imagery, State Vegetation Mapping (OEH, 2016b) and field assessments. Approximately 12.7% (635.31ha) of native vegetation occurs in the surrounding 1500 m buffer area. This vegetation, in the landscape surrounding the development site is predominantly open woodland comprised of Blakely's Red Gum (*Eucalyptus blakelyi*), Yellow Box (*Eucalyptus melliodora*), Western Grey Box (*Eucalyptus microcarpa*), White Box (*Eucalyptus albens*) and River Red Gum (*Eucalyptus camaldulensis*), and Plains Grass Grassland.

2.3 CLEARED AREAS

An assessment of cleared areas in the 1500 m buffer area was undertaken using aerial imagery, State Vegetation Mapping (OEH, 2016b), NSW Landuse Mapping (OEH, 2017) and field assessments. Approximately 87.7% (4524.16 ha) of the buffer area comprises cleared vegetation, predominantly cropped paddocks and occasional roads and residences.

Figure 2-1 Cleared Vegetation within the site

2.4 RIVER AND STREAMS

The proposal is located approximately 45 km north of the Murray River. Three watercourses run through or along the boundary of the development site, Billabong Creek to the north, Back Creek to the west, and two unnamed ephemeral drainage lines flow westward into Back Creek through the centre of the development site. These creeks are classified as first or second order streams under the Strahler Stream Classification System (DPI 2018). These creeks are generally dry, experiencing water flow only at times of high rainfall.

Twenty man-made farm dams exist within the development site (Figure 2-3). These dams are generally heavily utilised by stock and devoid of native vegetation.

Figure 2-2 Billabong Creek.

Figure 2-3 Farm Dam on site

2.5 WETLANDS

An EPBC Protected Matters search completed on 9th August 2019 identified seven wetlands of international importance. The closest of these are the Barmah Forest and NSW Central Murray State Forests both between 100 km and 150 km from the development site, upstream within the Murray Catchment. The EPBC Protected Matters search identified no nationally important wetland that would potentially be impacted by land use at the development site. Culcairn Swamp (Gum Swamp), is located about 2.5 km west from the development site and is a seasonal swamp that is mostly dry during the warmer months.

Several smaller, unlisted swamps were identified near the development site. These are shown in Figure 2 - 4 from the Greater Hume LEP.

Figure 2-4 Wetlands identified in the Greater Hume LEP.

2.6 CONNECTIVITY FEATURES

The 1.5 km buffer area is largely cleared and heavily fragmented and provides minimal connectivity. Back Creek provides a wildlife corridor through the bottom southwestern corner of the development site. A vegetated riparian corridor at Billabong Creek runs along the northern boundary of the site.

2.7 AREAS OF GEOLOGICAL SIGNIFICANCE

No karsts, caves, crevices or cliffs or other areas of geological significance occur in or adjacent to the development site.

2.8 AREAS OF OUTSTANDING BIODIVERSITY VALUE

No Areas of Outstanding Biodiversity Value (AOBV) occur within the development site.

2.9 SITE CONTEXT COMPONENTS

Method applied

The proposal conforms to the definition of a *site-based development* under the Biodiversity Assessment Methodology. The site-based development assessment methodology has been used in this BAM assessment. The Percent Native Vegetation was calculated by estimating the percent cover of native vegetation relevant to the benchmark for the PCT. PCTs were allocated based on existing vegetation mapping, field inspections and aerial imagery.

Percent Native Vegetation Cover

As determined by GIS mapping from aerial imagery, approximately 635.31 ha of native vegetation occurs in the 1500 m buffer area (Figure 2-4). This native vegetation in the landscape surrounding the development is considered to be predominantly grassy woodland comprised of Blakely's Red gum (*Eucalyptus blakelyi*), River Red Gum (*Eucalyptus camaldulensis*) and Yellow Box (*Eucalyptus melliodora*).

Eleven PCTs occurred in the 1500 m buffer area (Table 2-1). Areas of native vegetation were calculated using GIS mapping. The total area of the 1500 m^2 buffer area is 5159.47 ha. The Percent Native Vegetation Cover within the 1500 m buffer area surrounding the development site prior to the development was calculated to be 12.7 %. This was entered into the BAM calculator for the proposal.

Table 2-1 Percent Native Vegetation Cover in the buffer area.

Plant Community Type	Area of native vegetation (ha)
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion (PCT 5)	191.52
Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (PCT 17)	10.73
Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains (PCT 24)	8.24
Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion (PCT 45)	126.92
Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 74)	0.14
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (PCT 76)	100.01
Western Grey Box - Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 110)	2.80
Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone (PCT 237)	0.17
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW (PCT 249)	107.37
Box-gum Woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266)	3.71
Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277)	83.70
TOTAL	**635.31**

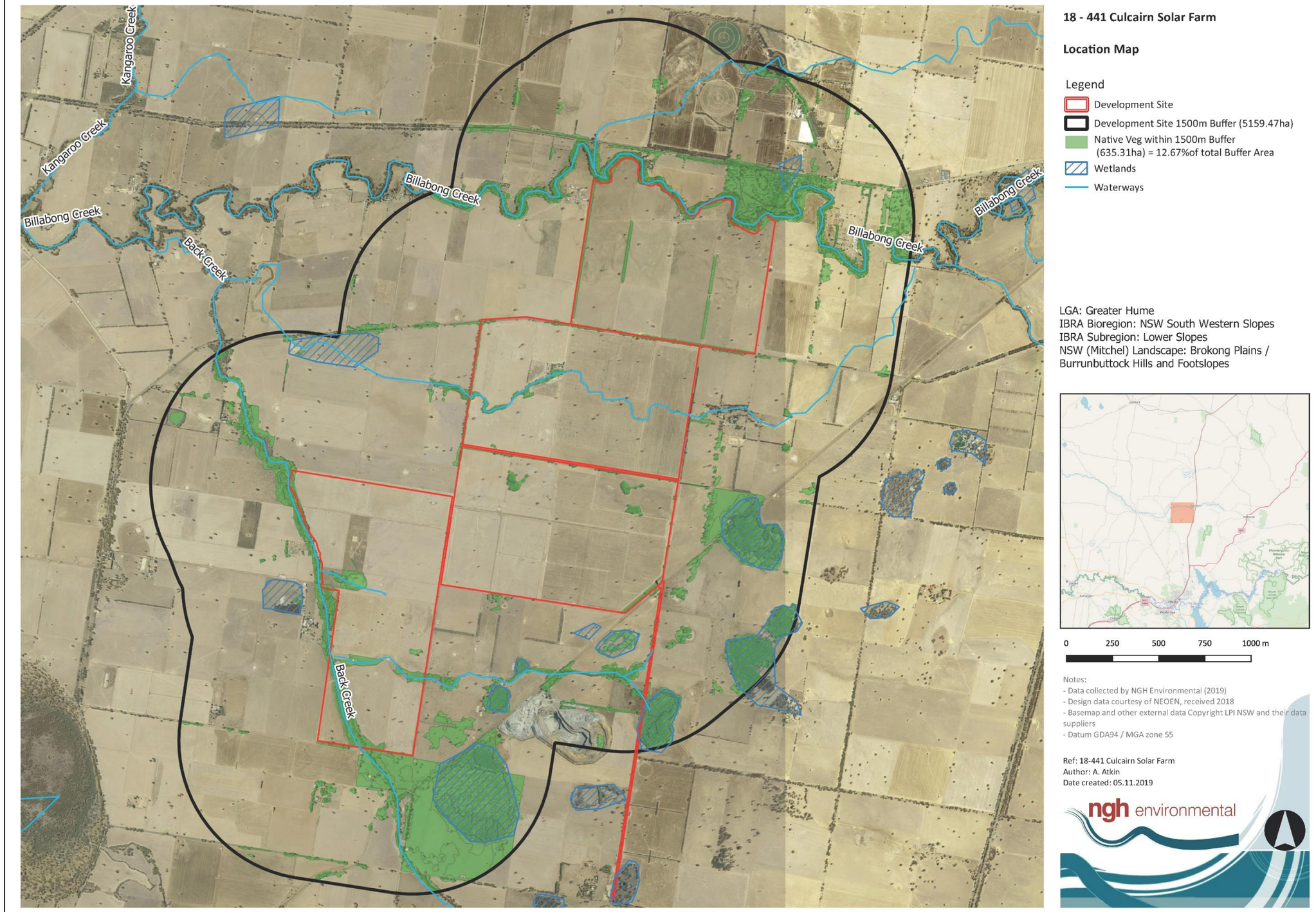


Figure 2-5 Location map

3 NATIVE VEGETATION

3.1 NATIVE VEGETATION EXTENT

This Percent Native Vegetation was calculated by estimating the percent cover of native vegetation relevant to the benchmark for the PCT. PCTs were allocated based on existing vegetation mapping, field inspections and aerial imagery.

70.52 ha of native vegetation occurs within the development site. This is comprised of:

- 20.80 ha of River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion (PCT 5)
- 14.03 ha of Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 74)
- 4.28 ha of Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (PCT 76)
- 3.48 ha of River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW (PCT 249)
- 27.93 ha of Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277)

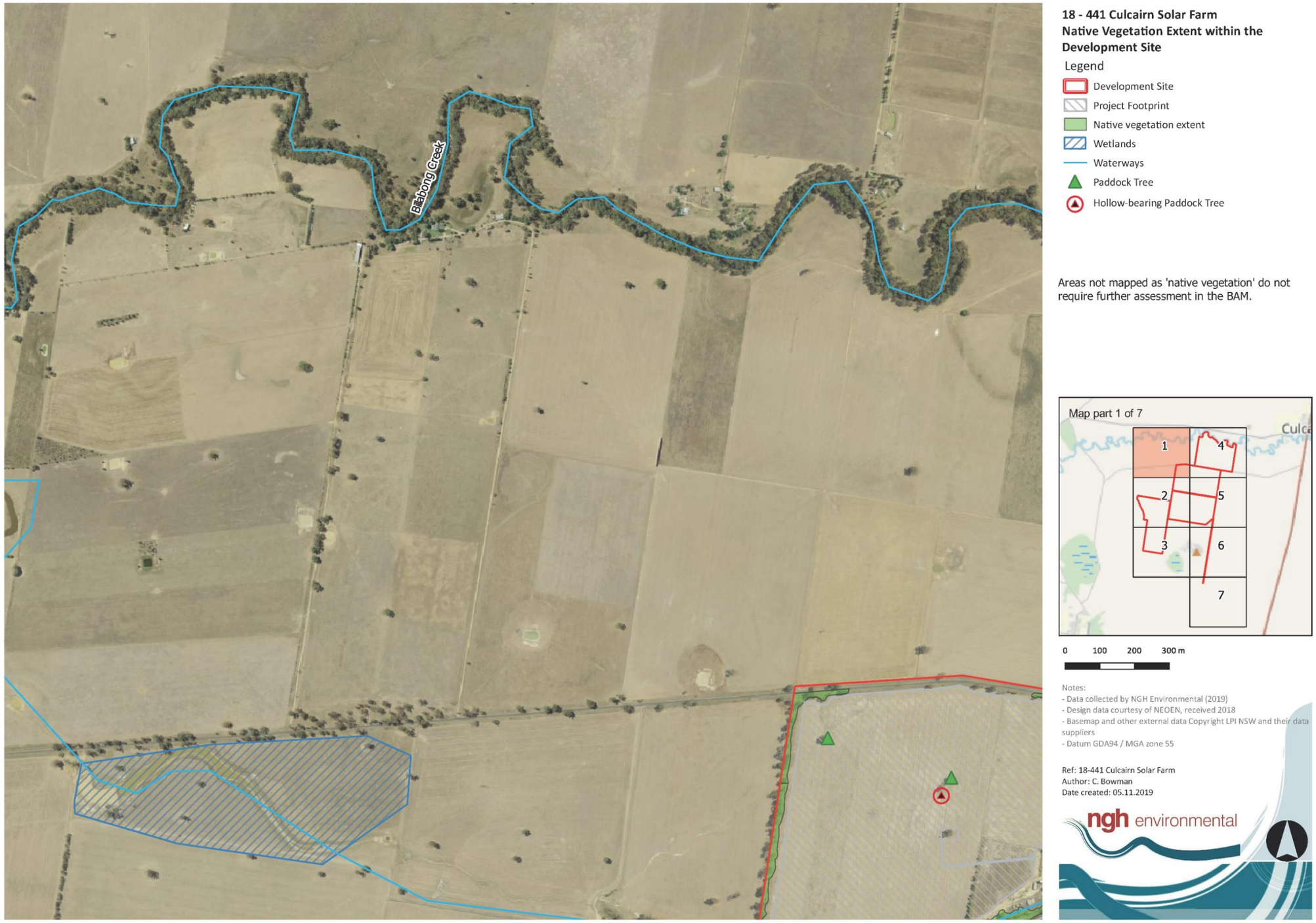
Approximately 1297 ha of the development site occurs as exotic grazed pasture. These areas are dominated by exotic vegetation such as Wheat (*Triticum aestivum*) and Barley (*Hordeum* sp.). These areas do not provide any threatened species habitat, will not be suitable for offsets and therefore do not require further assessment.

Ninety-nine (99) paddock trees including seventy-one (71) hollow bearing trees occur within the development site (Figure 3-1 to Figure 3-7). Paddock trees are defined as:

- a tree or a group of up to three trees less than 50 m apart from each other, and
- over an exotic groundcover, and
- more than 50 m away from any other living tree greater than 20 cm DBH, and
- on category 2 land surrounded by category 1 land (as defined by the BAM, 2017).[1]

Paddock trees throughout the development site were assessed under the streamlined assessment module – clearing paddock trees (Appendix 1 of the BAM) and incorporated into this report. They are considered both in terms of ecosystem credits and as habitat for threatened species and any credits generated are additional to those created by applying the full BAM.

[1] The regulatory land mapping has not been yet been published under the new *Local Land Service Act 2016* (LLS Act). During the transitional period, land categories are to be determined in accordance with the definitions of regulated land in the LLS Act. In this case, the paddock trees are located on land with native vegetation present since January 1990, surrounded by land that has been cleared of native vegetation since January 1990.



18 - 441 Culcairn Solar Farm
Native Vegetation Extent within the Development Site

Legend

- Development Site
- Project Footprint
- Native vegetation extent
- Wetlands
- Waterways
- Paddock Tree
- Hollow-bearing Paddock Tree

Areas not mapped as 'native vegetation' do not require further assessment in the BAM.

0 100 200 300 m

Notes:
- Data collected by NGH Environmental (2019)
- Design data courtesy of NEOEN, received 2018
- Basemap and other external data Copyright LPI NSW and their data suppliers
- Datum GDA94 / MGA zone 55

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Figure 3-1 Native vegetation extent within the development site

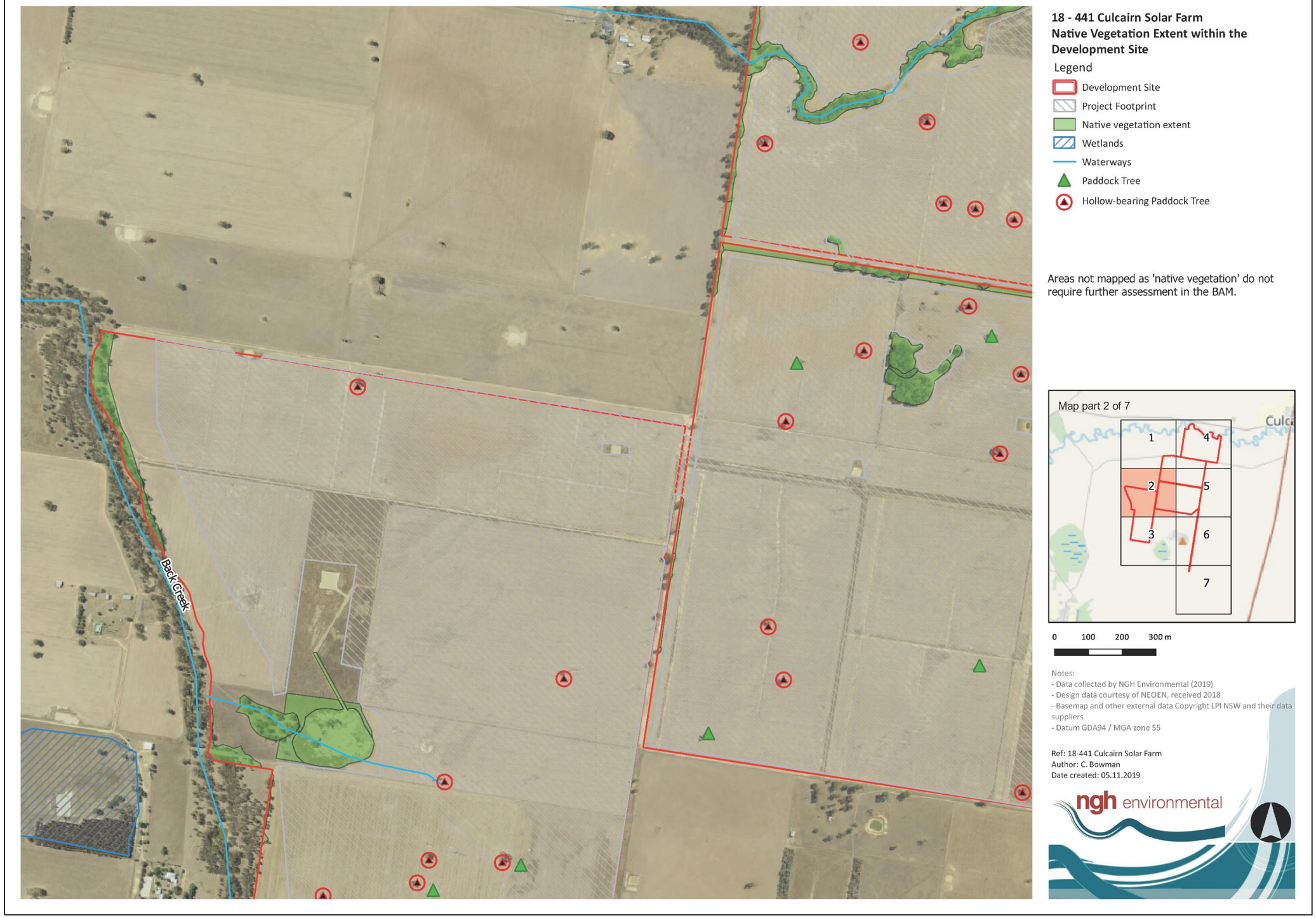


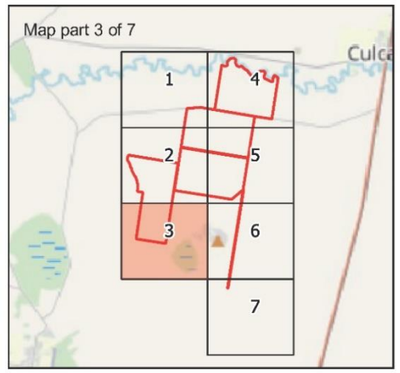
Figure 3-2 Native vegetation extent within the development site

18 - 441 Culcairn Solar Farm
Native Vegetation Extent within the Development Site

Legend

- Development Site
- Project Footprint
- Native vegetation extent
- Wetlands
- Waterways
- Paddock Tree
- Hollow-bearing Paddock Tree

Areas not mapped as 'native vegetation' do not require further assessment in the BAM.



0 100 200 300 m

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Author: C. Bowman
Date created: 05.11.2019

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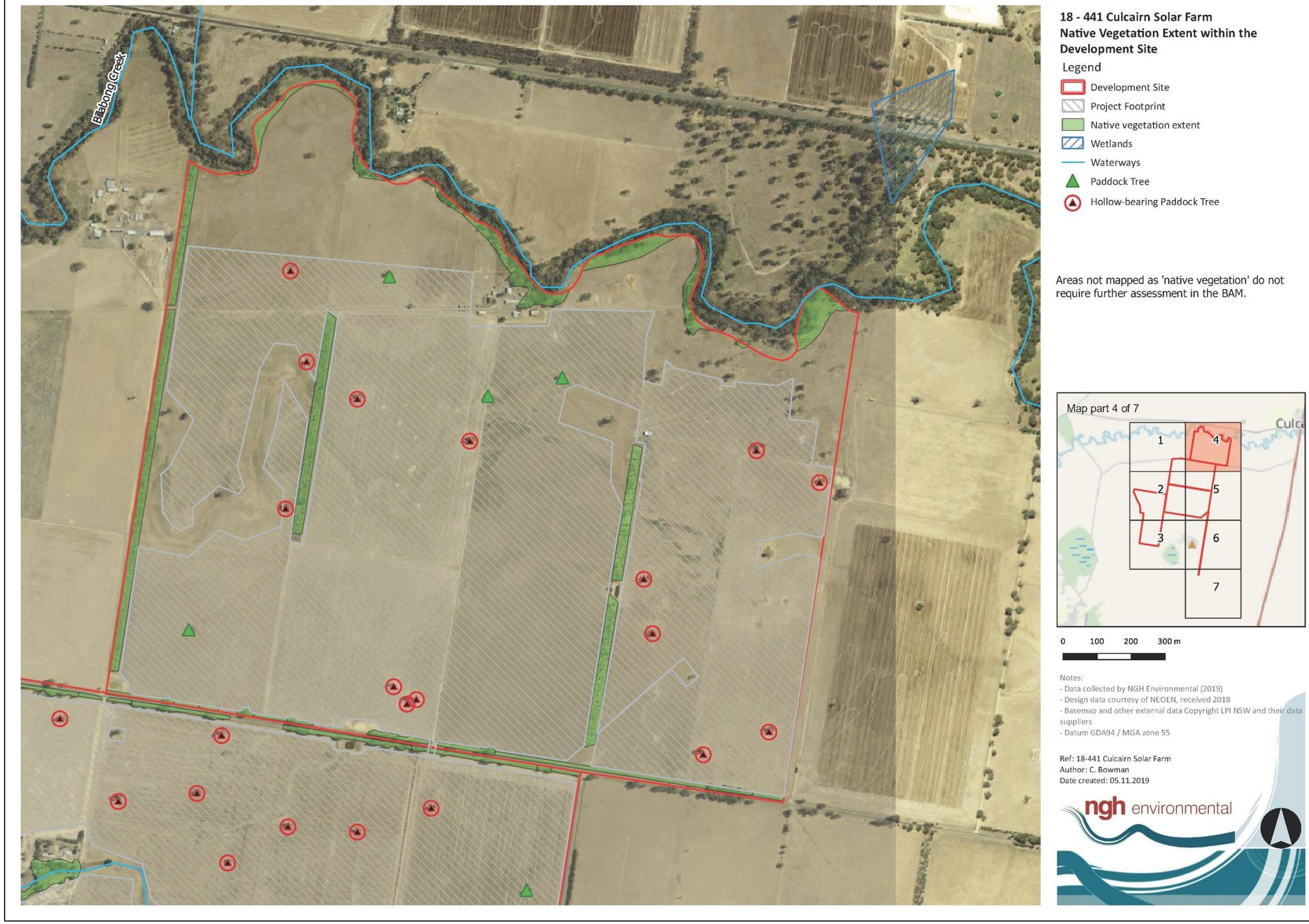
Figure 3-3 Native vegetation extent within the development site



18 - 441 Culcairn Solar Farm
Native Vegetation Extent within the Development Site

Legend

- Development Site
- Project Footprint
- Native vegetation extent
- Wetlands
- Waterways
- Paddock Tree
- Hollow-bearing Paddock Tree

Areas not mapped as 'native vegetation' do not require further assessment in the BAM.

0 100 200 300 m

Notes:
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Figure 3-4 Native vegetation extent within the development site

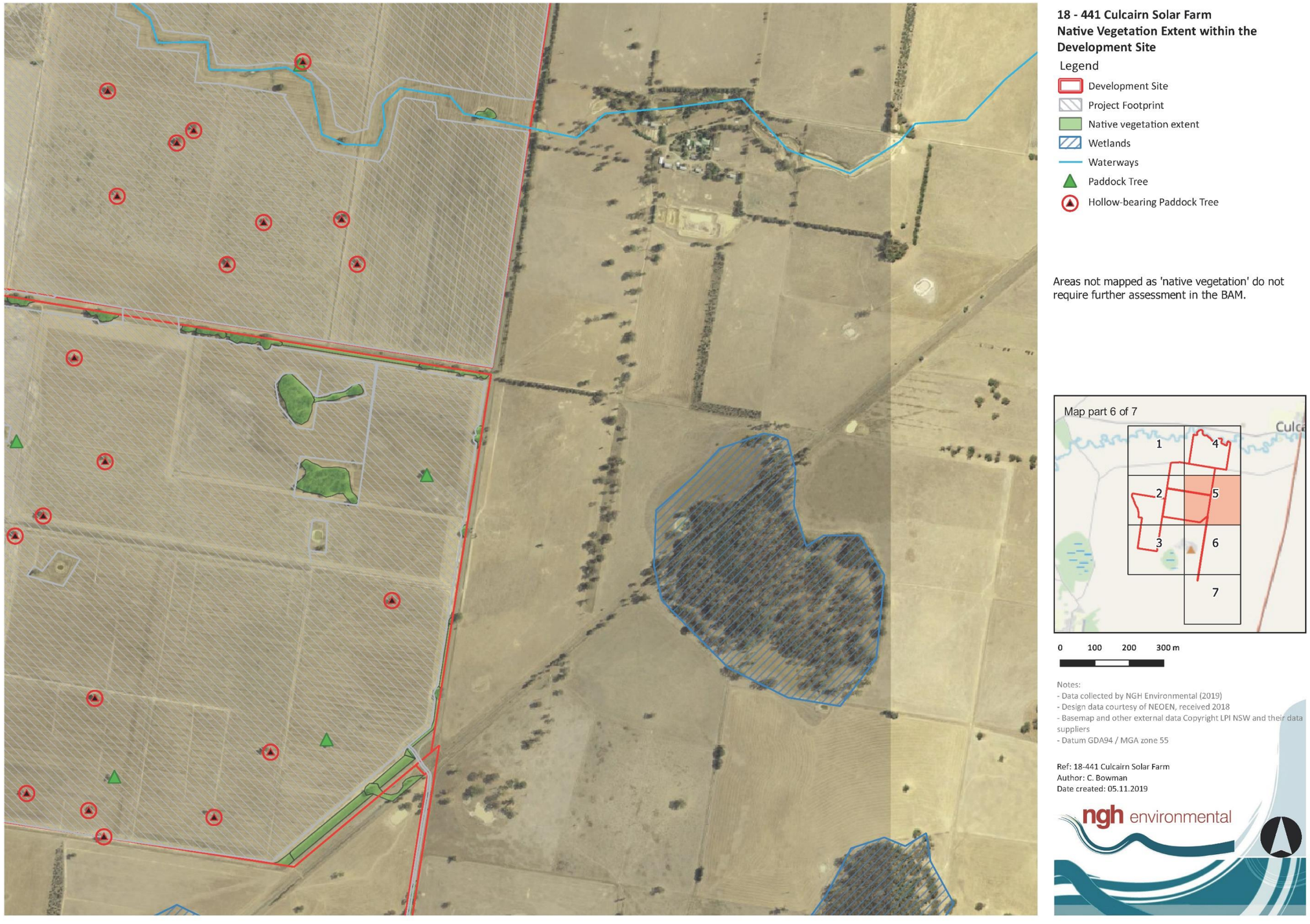


Figure 3-5 Native vegetation extent within the development site

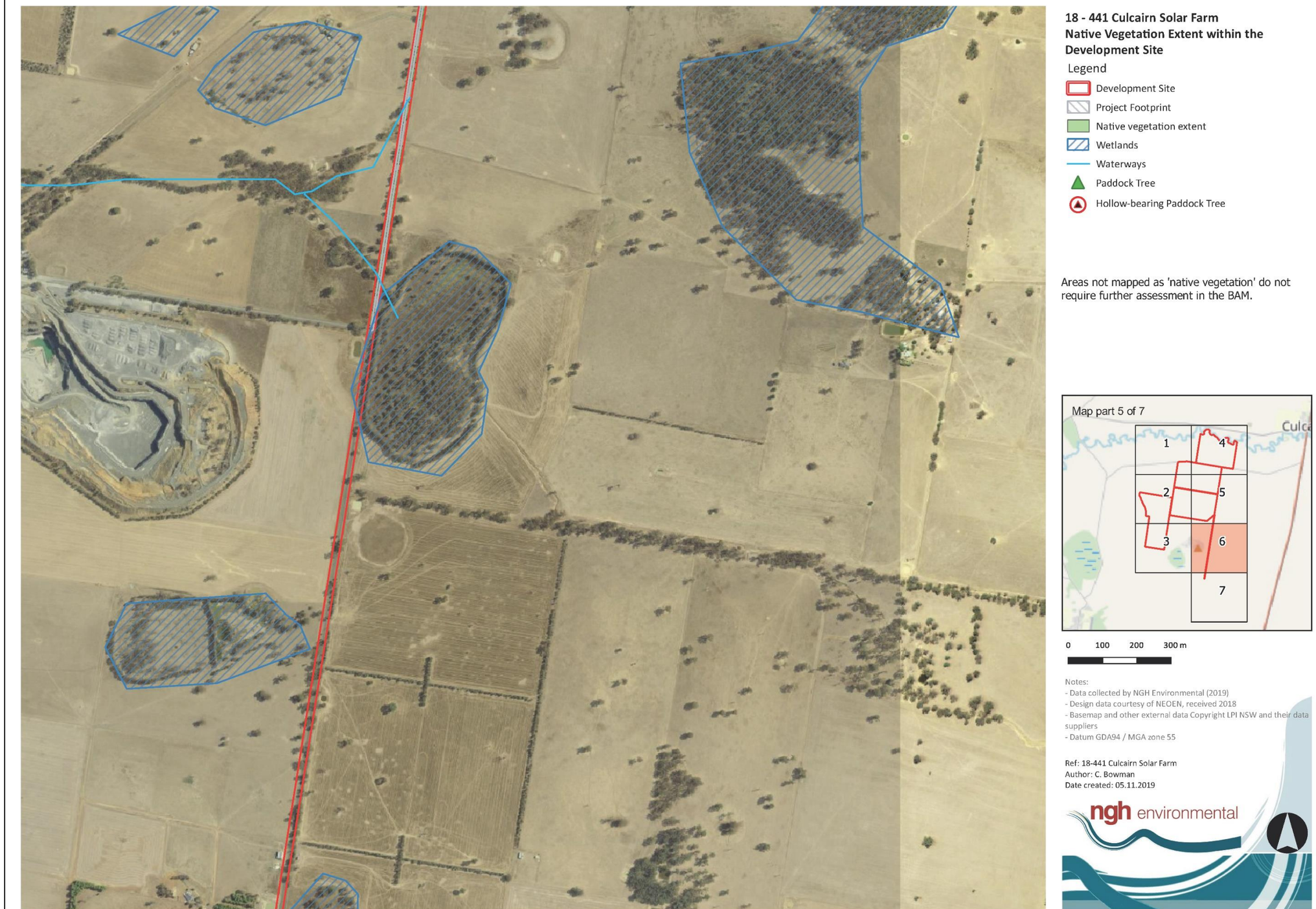


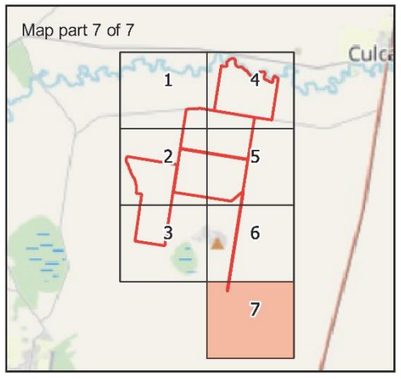
Figure 3-6 Native vegetation extent within the development site

18 - 441 Culcairn Solar Farm
Native Vegetation Extent within the Development Site

Legend

- Development Site
- Project Footprint
- Native vegetation extent
- Wetlands
- Waterways
- Paddock Tree
- Hollow-bearing Paddock Tree

Areas not mapped as 'native vegetation' do not require further assessment in the BAM.



0 100 200 300 m

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Figure 3-7 Native vegetation extent within the development site

3.2 PLANT COMMUNITY TYPES (PCTS)

3.2.1 Methods to assess PCTs

Review of existing information

A search was undertaken of OEH Vegetation Information System (VIS) database and NSW SEED mapping to access existing vegetation mapping information within the development site. Four relevant existing vegetation maps were assessed including *Terrestrial Biodiversity Map of the Greater Hume LEP 2012* plus the most up to date OEH data on the SEED Portal.

Floristic survey

Field surveys were completed over two periods, from the 28th and 29th November, and 18th December to the 21st December 2018. Additional surveys were undertaken on 12 August 2019 due to a modified design footprint. The entire subject land was surveyed by two ecologists by car and on foot. The aim of this survey was to determine the PCTs present in the development site and their condition and extent. Random meander searches were conducted in areas of native vegetation to determine the plant species present. PCTs were identified from the native species present, landforms and physiography and location in the IBRA subregion using the BioNet Vegetation Classification Database. The subject land was then stratified into areas of similar condition class to determine vegetation zones for each PCT.

Vegetation integrity plots of 20 m by 50 m (or 10 m by 100 m in the case of roadside verge) were established in each vegetation zone. Data was collected on the composition, structure and function of the vegetation. Data was collected utilising the methodology presented in the BAM 2017 by persons trained in the BAM and under the direction of persons accredited under the BAM including:

a) a description of the systematic field-based floristic vegetation survey using documented and repeatable methods;
b) a description of the systematic survey effort of the subject land, ensuring it was commensurate with the expected environmental variation;
c) how the plot-based floristic vegetation survey intensity has sampled the expected environmental variation between stratified environmental units; and
d) that the survey effort was targeted to fill gaps in the existing mapping and site information.

3.2.2 PCTs identified on the development site

Five PCTs occur within the development site as shown in Figure 3-12 to Figure 3-18, including:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.
- PCT 74 – Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion.
- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.
- PCT 249 –River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.

- PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.
- Patches of derived grassland communities associated with the above PCTs were also identified in low condition throughout the site.

A description of each of the PCTs identified in the development site follow in Table 3-1 to Table 3-5 below which include justification of PCT selection.

Table 3-1 River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion

River Red Gum Herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.		
Vegetation formation	Forested Wetlands	
Vegetation class	Inland Riverine Forests	
Vegetation type	**PCT ID**	5
	Common Community Name	River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.
Approximate extent within the development site	The extent of this PCT within the development site is 20.80 ha in vegetated riparian corridors along to Back Creek.	
Species relied upon for PCT identification	***Species name***	***Relative abundance***
	Eucalyptus camaldulensis	20%
	Eryngium ovinum	0.5%
	Rumex brownii	1%
	Lobelia purpurascens	1%
	Juncus spp.	1%
	Carex inversa	5%
Justification of evidence used to identify the PCT	This PCT was identified with a dominance of River Red Gum (*E. camaldulensis*). The shrub layer is absent and the ground cover is highly disturbed through frequent grazing by sheep and cattle. Five PCTS were considered that have River Red Gum as the dominant species in the NSW South Western Slopes. These are: *PCT 2 - River Red Gum-sedge dominated very tall open forest in frequently flooded forest wetland along major rivers and floodplains in south-western NSW Based on the species.* *PCT 5 - River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.* *PCT 7 - River Red Gum - Warrego Grass - herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion.* *PCT 9 - River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion.* *PCT 249 --River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.* Very little understory vegetation remains and it is difficult to distinguish between the PCTS based on understory species. PCT 5 was considered the best match for the PCT based on existing vegetation mapping and location in the landscape.	

River Red Gum Herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.	
TEC Status	Not listed under either the BC Act or EPBC Act
Estimate of percent cleared	Current extent = 9000 ha (40% cleared)
Examples	 Figure 3-8 River Red Gum Herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.

Table 3-2 Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion

Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion		
Vegetation formation	Grassy Woodlands	
Vegetation class	Floodplain Transition Woodlands	
Vegetation type	**PCT ID**	74
	Common Community Name	Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion
Approximate extent within the development site	The extent of this PCT within the development site is 14.03 ha in vegetated riparian corridors along to Back Creek and Billabong Creek.	
Species relied upon for PCT identification	**Species name**	**Relative abundance**
	Eucalyptus camaldulensis	1%
	Eucalyptus blakelyi	1%
	Persicaria decipiens	0.5%
	Cynodon dactylon	20%
	Rumex brownii	1%
Justification of evidence used to identify the PCT	This PCT was identified with a dominance of River Red Gum (*E. camaldulensis*) as part of a larger patch including Yellow Box (*E. melliodora*) along the riparian corridor of Back Creek. Ground cover is highly disturbed through frequent grazing by sheep and cattle. PCT 74 was considered the best match for the PCT based on overstory species, existing vegetation mapping and location in the landscape.	
TEC Status	Listed as White Box Yellow Box Blakely's Red Gum Woodland; Critically Endangered under the BC Act. The extent within the development site does not meet the criteria for the TEC listed under the EPBC Act	
Estimate of percent cleared	Current extent = 8000 ha (73% cleared)	

Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	
Examples	 Figure 3 -9 Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion

Table 3-3 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions

Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions		
Vegetation formation	Grassy Woodlands	
Vegetation class	Floodplain Transition Woodlands	
Vegetation type	**PCT ID**	76
	Common Community Name	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
Approximate extent within the development site	The extent of this PCT within the development site is 4.28 ha adjacent to riparian areas or farm dams within paddocks.	
Species relied upon for PCT identification	**Species name**	**Relative abundance**
	Eucalyptus microcarpa	20%
	Rytidosperma spp.	1%
Justification of evidence used to identify the PCT	This PCT was identified by a dominance of Western Grey Box (*E. microcarpa*) in the overstory. The understory has been heavily disturbed through agricultural activities of cropping and continuous grazing by livestock. The shrub layer is absent, and the groundcover is mostly comprised of exotic annuals. Some native groundcovers persist on the road reserves. Two PCTS were considered that have Western Grey Box as the dominant overstory species in the NSW South West Slopes. These are: • PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregion. • PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil of alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion. As White Cypress Pine was not dominant in the landscape, PCT 80 was not considered a suitable PCT for the remnant Grey Box Woodland. PCT 76 was considered to be most suitable PCT based on: • Dominated by Grey Box in the overstory. • Located in the Inland Slopes IBRA Subregion. • Occurs on flats and floodplains. • Species listed above characteristic of this community. • Existing Vegetation Mapping for this PCT present in the locality. For these reasons, PCT was selected as the most appropriate PCT.	
TEC Status	Listed as Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion, Endangered under the BC Act. The extent within the development site does not meet the criteria for the TEC listed under the EPBC Act.	

Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	
Estimate of percent cleared	Current extent = 40 000 ha (92% cleared)
Examples	 Figure 3-9 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions

Table 3-4 River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW

River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW		
Vegetation formation	Forested Wetlands	
Vegetation class	Inland Riverine Forests	
Vegetation type	**PCT ID**	249
	Common Community Name	River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW
Approximate extent within the development site	The extent of this PCT within the development site is 3.48 ha surrounding a farm dam.	
Species relied upon for PCT identification	**Species name**	**Relative abundance**
	Eucalyptus camaldulensis	2%
	Cynodon dactylon	90%
	Juncus spp.	10%
	Persicaria decipiens	1%
Justification of evidence used to identify the PCT	This PCT was identified with a dominance of River Red Gum (*E. camaldulensis*). The shrub layer is absent and the ground cover is highly disturbed through frequent grazing by sheep and cattle. Five PCTS were considered that have River Red Gum as the dominant species in the NSW South Western Slopes. These are: *PCT 2 - River Red Gum-sedge dominated very tall open forest in frequently flooded forest wetland along major rivers and floodplains in south-western NSW Based on the species.* *PCT 5 - River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.* *PCT 7 - River Red Gum - Warrego Grass - herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion.* *PCT 9 - River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion.* *PCT 249 --River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.* Very little understory vegetation remained and it was difficult to distinguish between the PCTS based on understory species. PCT 249 was considered the best match for the PCT based on existing vegetation mapping and location in the landscape.	
TEC Status	Does not form part of a TEC	
Estimate of percent cleared	Current extent 3500 ha (50% cleared)	

River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	
Examples	 Figure 3-10 River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW

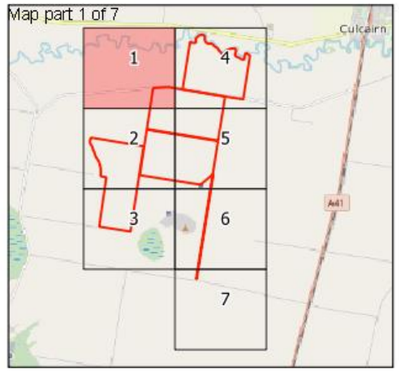
Table 3-5 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion

Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion			
Vegetation formation	Grassy Woodlands		
Vegetation class	Western Slopes Grassy Woodlands		
Vegetation type	**PCT ID**	277	
	Common Community Name	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	
Approximate extent within the development site	The extent of this PCT within the development site is 27.93 as patches of remnant trees within paddocks or in strips along fences lines and boundaries.		
Species relied upon for PCT identification	**Species name**		**Relative abundance**
	Eucalyptus blakelyi		30%
	Eucalyptus melliodora		15%
	Einadia nutans		0 -5%
	Chloris truncata		0-10%
	Lomandra filiformis		0 – 0.3%
	Desmodium varians		0 -1%
Justification of evidence used to identify the PCT	This woodland is comprised of patches of trees within cropped paddocks that are used for heavy grazing. The PCT was assigned based on the overstory species and groundcover species where present including Blakely's Red Gum and Yellow Box that are characteristic to this PCT in the IBRA subregion.		
TEC Status	Listed as White Box Yellow Box Blakely's Red Gum Woodland, Critically Endangered under the BC Act. The extent within the development site does not meet the criteria for the critically endangered ecological community listed under the EPBC Act		
Estimate of percent cleared	Current extent = 30 000 ha (94% cleared)		

Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	
Examples	 Figure 3-11 Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion

18 - 441 Culcairn Solar Farm
PCTs and TECs at the Development Site

Legend
- Development footprint
- Development Site
- Waterways
- Wetlands
- Public Roads
- Plant community types (codes)
  - 74
  - 277



0 100 200 300 m

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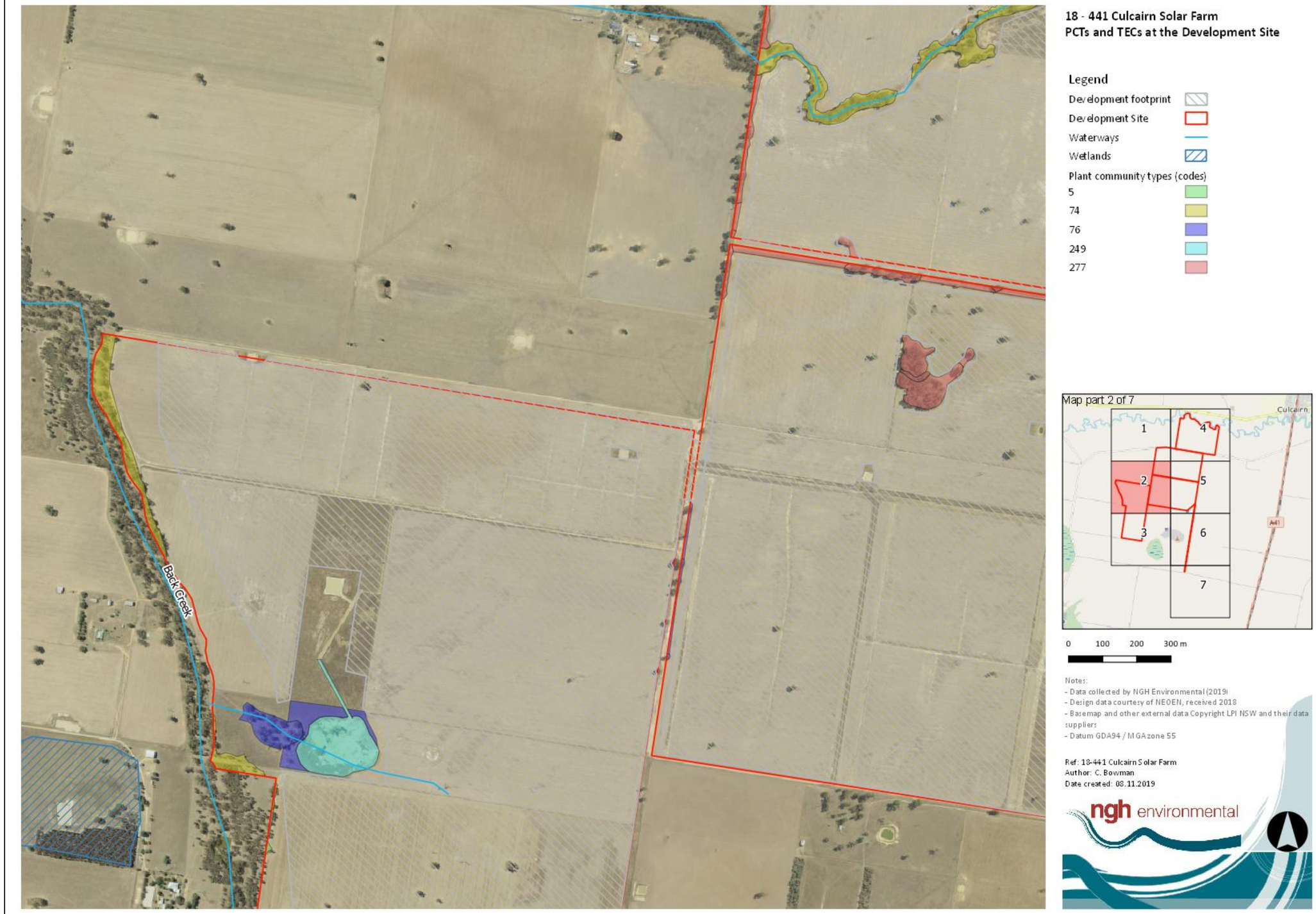
Figure 3-12 PCTs and TECs at the development site



18 - 441 Culcairn Solar Farm
PCTs and TECs at the Development Site

Legend
Development footprint
Development Site
Waterways
Wetlands
Plant community types (codes)
5
74
76
249
277

0 100 200 300 m

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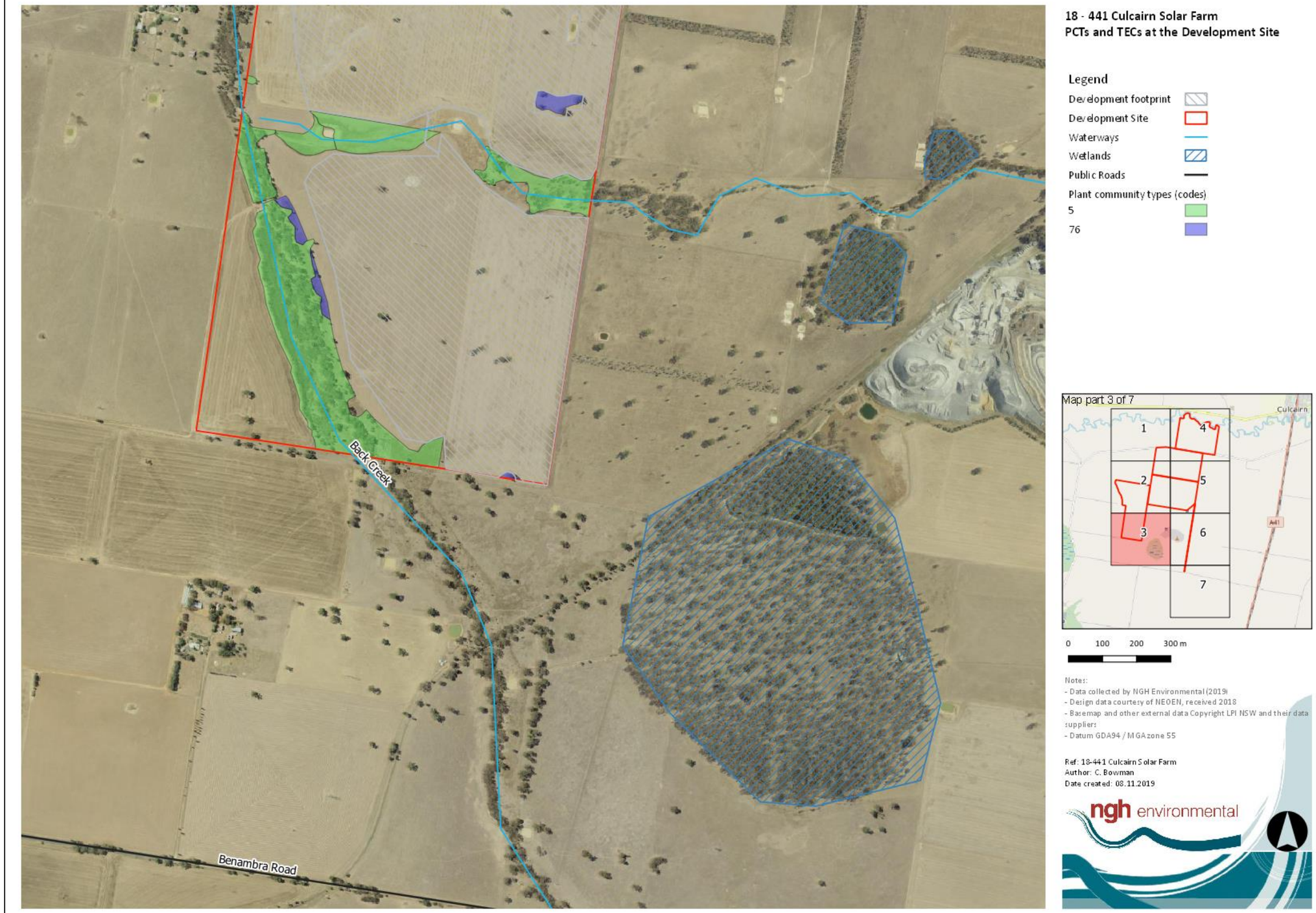
Figure 3-13 PCTs and TECs at the development site



18 - 441 Culcairn Solar Farm
PCTs and TECs at the Development Site

Legend
- Development footprint
- Development Site
- Waterways
- Wetlands
- Public Roads
- Plant community types (codes)
  - 5
  - 76

0 100 200 300 m

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Figure 3-14 PCTs and TECs at the development site

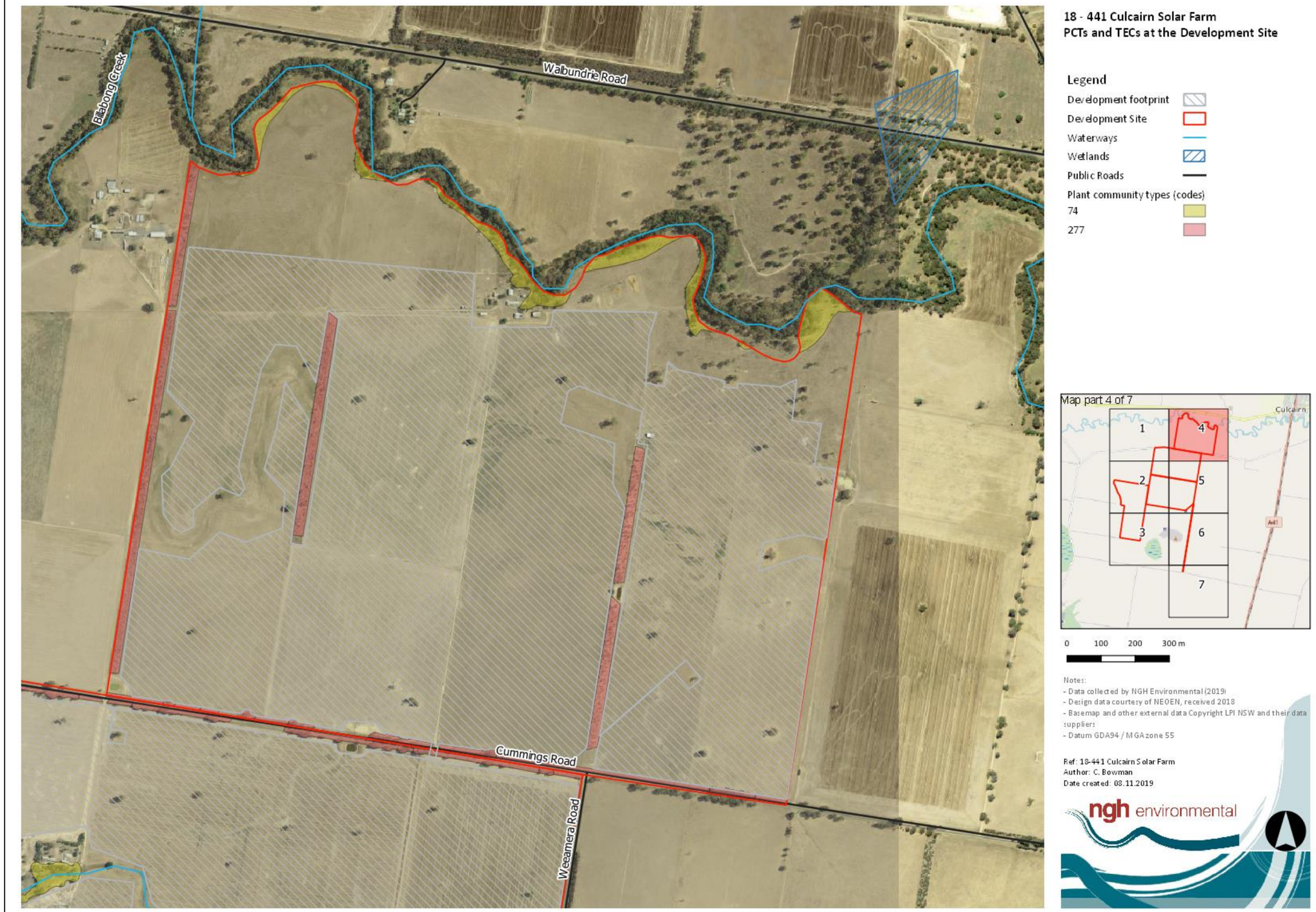


Figure 3-15 PCTs and TECs at the development site

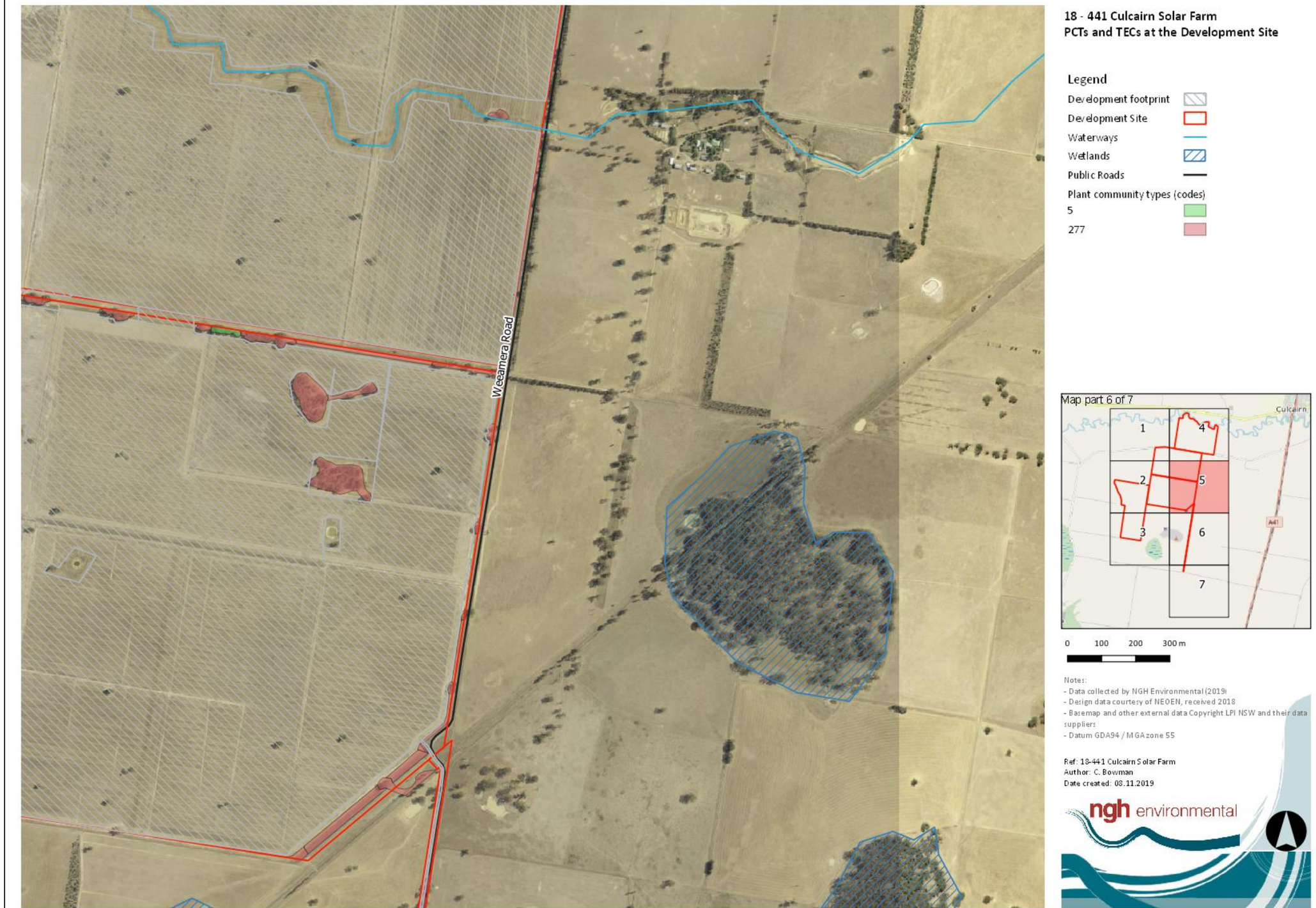
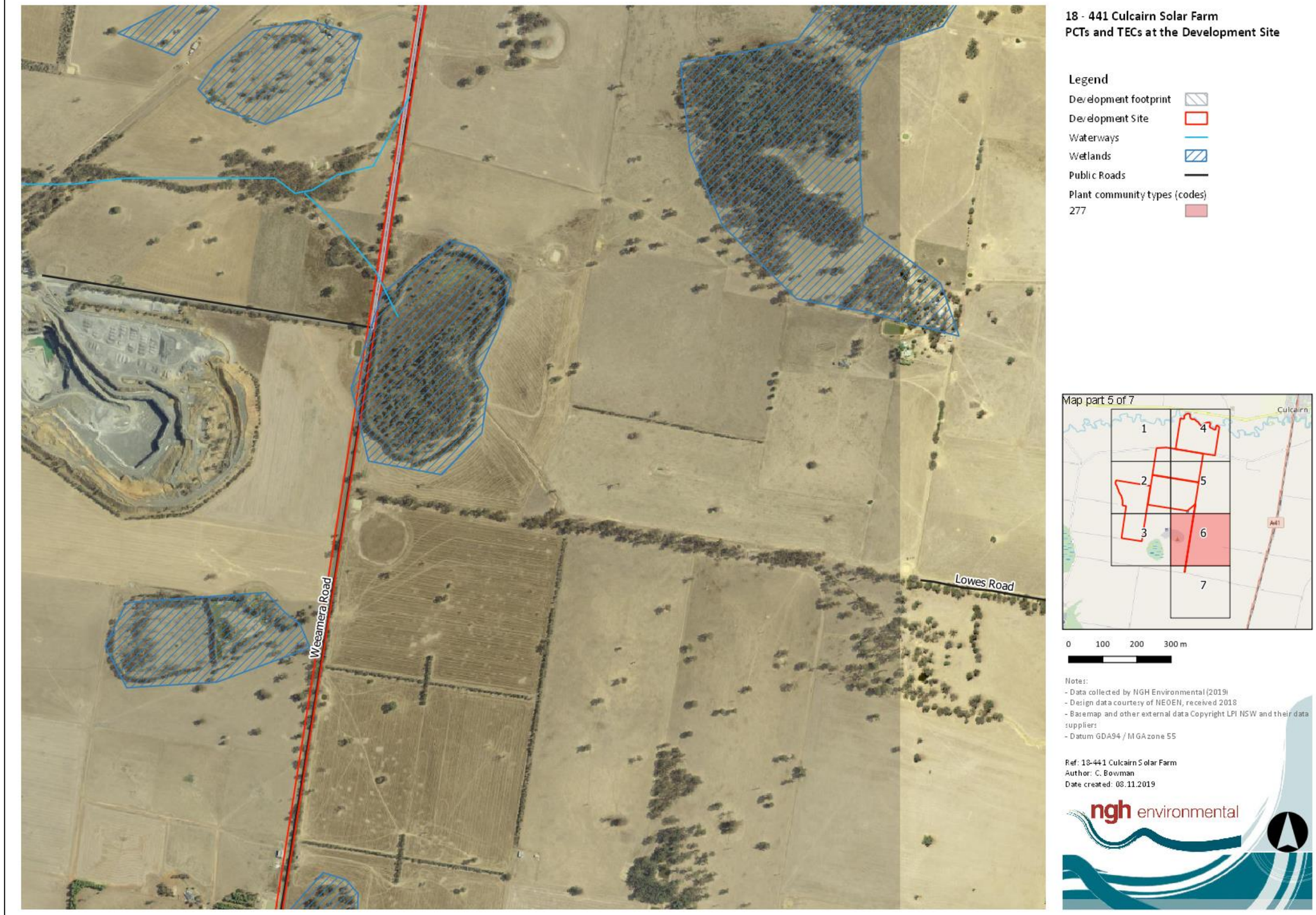


Figure 3-16 PCTs and TECs at the development site



18 - 441 Culcairn Solar Farm
PCTs and TECs at the Development Site

Legend
Development footprint
Development Site
Waterways
Wetlands
Public Roads
Plant community types (codes)
277

0 100 200 300 m

Notes:
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Figure 3-17 PCTs and TECs at the development site

Figure 3-18 PCTs and TECs at the development site

1.1 VEGETATION INTEGRITY ASSESSMENT

1.1.1 Vegetation zones and survey effort

The random meander, overview inspection and vegetation integrity plots have been used to assist the delineation of zones. Five PCTs were identified in the development site. Each of these PCTs were stratified into zones on the basis of current condition state, vegetation structure, land management practices or other environmental variables. Twenty-eight (28) vegetation integrity plots were undertaken during the field surveys. The number of vegetation integrity plots undertaken in each zone conformed with the minimum plot requirements per zone area as specified in the BAM (2017). Vegetation zones are detailed in Table 3-6and mapped in Figures 3-19 to 3-25 below.

Table 3-6 Vegetation zones for the development site.

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
5_Native_Understory	5	**Native Understorey** This zone consists of a woodland of mature River Red Gum (*E. camaldulensis*) trees occurring in small drainage depressions in the landscape. These areas would hold water in times of substantial rainfall. Grazing occurs in these areas but native understory species such as Juncus spp. and Swamp Dock (*Rumex brownii*). Fallen timber has been left in these areas, providing good fauna habitat. This zone does not form part of a TEC under the BC or EPBC act.	17.23	0	2	100+ ha	
5_Derived_Grassland	5	**Derived Grassland** This zone consists of a disturbed grassland. It has undergone regular grazing by livestock, but there has been no evidence of cropping in the past. The grassland is dominated by a mix of exotic Barley Grass (**Hordeum leporinum*) and native Windmill Grass (*Chloris truncata*). Some other natives such as Couch (*Cynodon dactylon*), Curly Windmill Grass (*Enteropogon acicularis*), Caustic Weed (*Euphorbia drummondii*) and Wallaby grass	3.43	0	1	100+ ha	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
		(*Rytidosperma spp.*) were also present 0in very small abundance (<1% cover). T0his zone does not form part of a TEC under the BC or EPBC act.					
74_Low_Condition	74	**Low Condition** This zone consists of mature Blakley's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) trees over a disturbed understorey. Any native understory has been eliminated through agricultural activities of cropping and grazing. This zone was considered to be of low condition. This zone forms part of the TEC listed under the BC Act as *White Box Yellow Box Blakely's Red Gum Woodland.*	5.27	0	0	100+ ha	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
74_Mod_Condition	74	**Moderate Condition** This zone consists of mature Blakley's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) trees over a disturbed understorey including a native component. This zone was considered to be of moderate condition. This zone forms part of the TEC listed under the BC Act as *White Box Yellow Box Blakely's Red Gum Woodland.*	8.76	0	1	100+ ha	
76_Derived_Grassland	76	**Derived Grassland** This zone consists of a disturbed grassland. It has undergone regular grazing by livestock, but there has been no evidence of cropping in the past. The grassland is dominated by a mix of exotic Barley Grass (**Hordeum leporinum*) and native Windmill Grass (*Chloris truncata*). Some other natives such as Couch (*Cynodon dactylon*), Curly Windmill Grass (*Enteropogon acicularis*), Caustic Weed (*Euphorbia drummondii*) and Wallaby grass (*Rytidosperma spp.*) were also present in very small abundance (<1% cover).	2.13	0	1	5	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
		This zone is considered to form part of PCT 76 due to scattered and isolated Grey Box occurring in this paddock. It does not form part of the TEC *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion*s as the understory is exotic dominated and very few native grasses or forbs remain.					
76_Exotic_Understory	76	**Exotic Understorey** This zone consists of mature Grey Box (*E. microcarpa*) trees over a disturbed understorey. Any native understory has been eliminated through agricultural activities of cropping and grazing. This zone forms part of the TEC listed under the BC Act as *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion*s	1.93	0	1	2.5	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
76_Native_Understory	76	**Native Understorey** This zone consists of mature Grey Box (*E. microcarpa*) trees over a disturbed understorey with some native component in small abundance. This zone forms part of the TEC listed under the BC Act as *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*	0.22	0	1	2	
249_Native_Understory	249	**Native Understorey** This zone consists of a woodland of mature River Red Gum (*E. camaldulensis*) trees occurring adjacent to a dam. Grazing occurs in these areas but native understory species such as *Juncus spp.* and *Persicaria decipiens* persist. This zone forms part of the TEC listed under the BC Act as *Artesian Springs Ecological Community in the Great Artesian Basin*.	3.46	0	1	5	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
277_Derived_Grassland	277	**Derived Grassland** This zone consists of a disturbed grassland. It has undergone regular grazing by livestock, but there has been no evidence of cropping in the past. The grassland is dominated by a mix of exotic Barley Grass (**Hordeum leporinum*) and native Windmill Grass (*Chloris truncata*). Some other natives such as Couch (*Cynodon dactylon*), Curly Windmill Grass (*Enteropogon acicularis*), Caustic Weed (*Euphorbia drummondii*) and Wallaby grass (*Rytidosperma spp.*) were also present in very small abundance (<1% cover). It does not form part of the TEC listed under the BC Act as *White Box Yellow Box Blakely's Red Gum Woodland* as the understory is exotic dominated and very few native grasses or forbs remain.	4.53	0.01	1	5	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
277_Exotic_Understory	277	**Exotic Understorey** This zone consists of mature Blakley's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) trees over a disturbed understorey. Any native understory has been eliminated through agricultural activities of cropping and grazing. This zone was considered to be of low condition. This zone forms part of the TEC listed under the BC Act as *White Box Yellow Box Blakely's Red Gum Woodland*.	12.89	0.59	6	15	
277_Native_Understory	277	**Native Understorey** This zone consists of mature Blakley's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) trees with native groundcover species present. This zone forms part of the TEC listed under the BC Act as *White Box Yellow Box Blakely's Red Gum Woodland*.	1.31	0.01	1	2	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
277_Planted	277	**Planted** This zone consists of immature Eucalypt species planted in landscape strips between cropping areas and along fence lines. This zone forms part of the TEC listed under the BC Act as *White Box Yellow Box Blakely's Red Gum Woodland*.	8.38	0	1	100+ ha	
277_Regeneration	277	**Regeneration** This zone consists of mature and regenerating Blakley's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) trees. Native midstorey and groundcover species are largely absent due to grazing pressure. This zone forms part of the TEC listed under the BC Act as *White Box Yellow Box Blakely's Red Gum Woodland*.	0.85	0	1	10 ha	

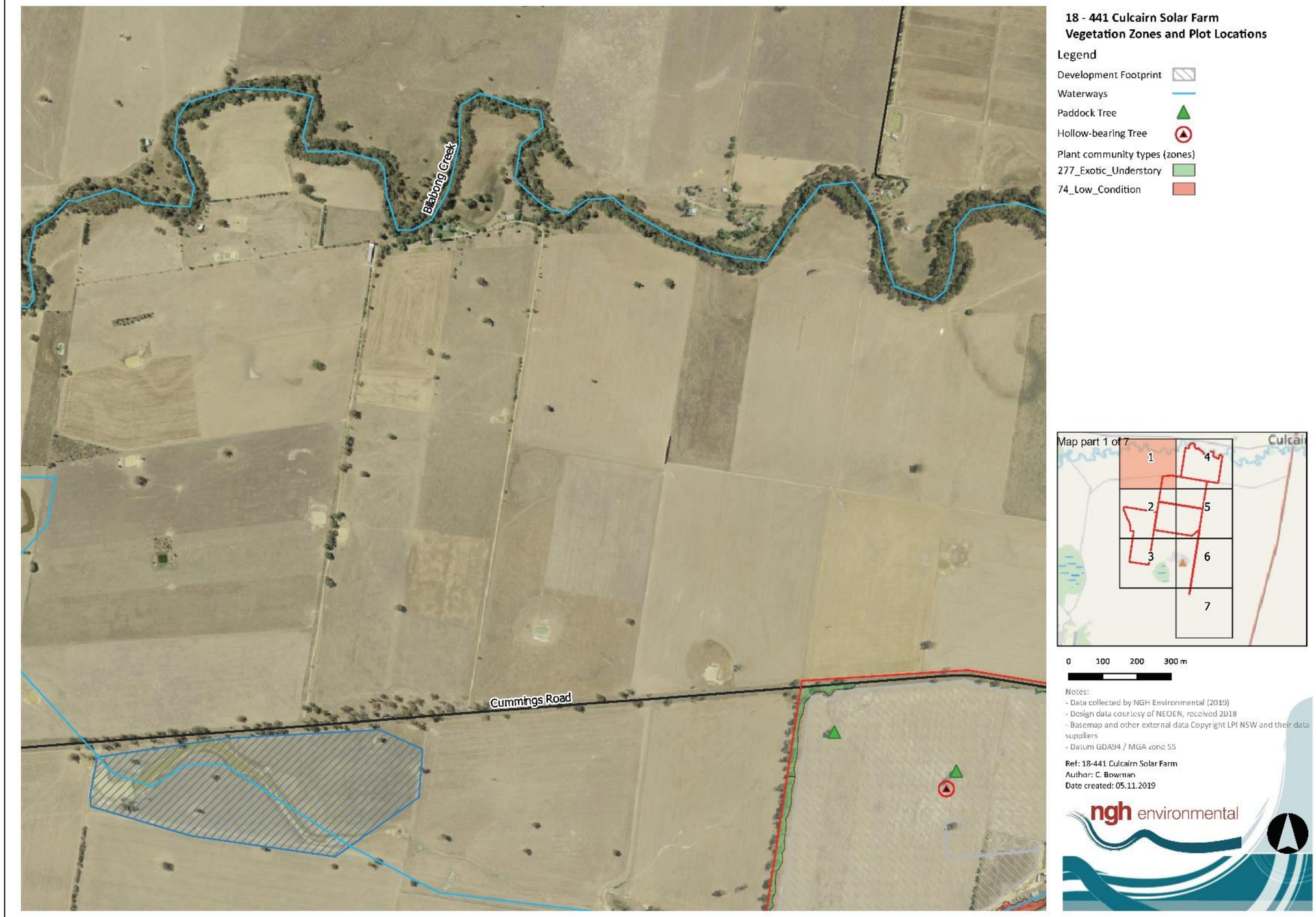


Figure 3-19 Vegetation zones at the development site

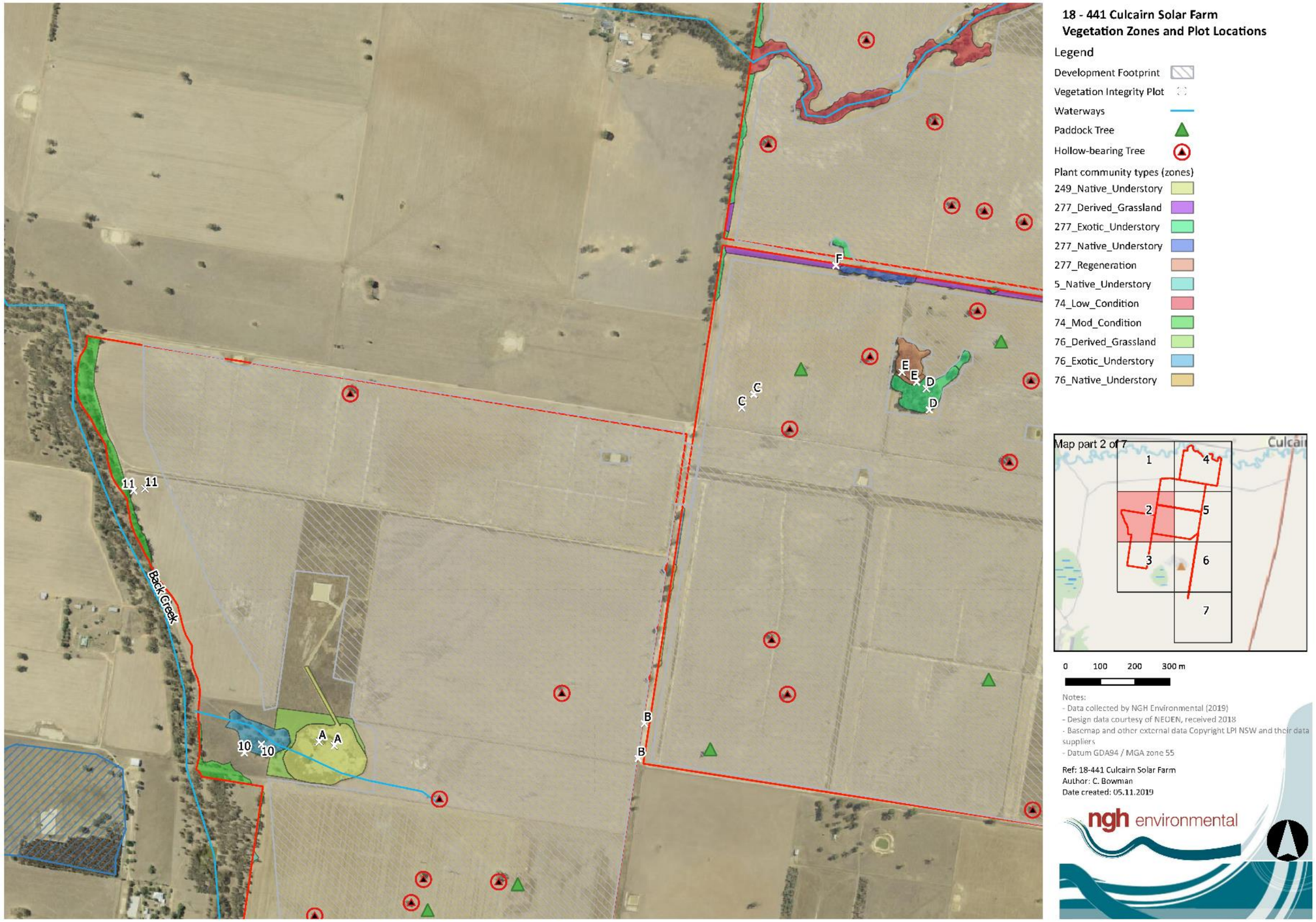


Figure 3-20 Vegetation zones at the development site

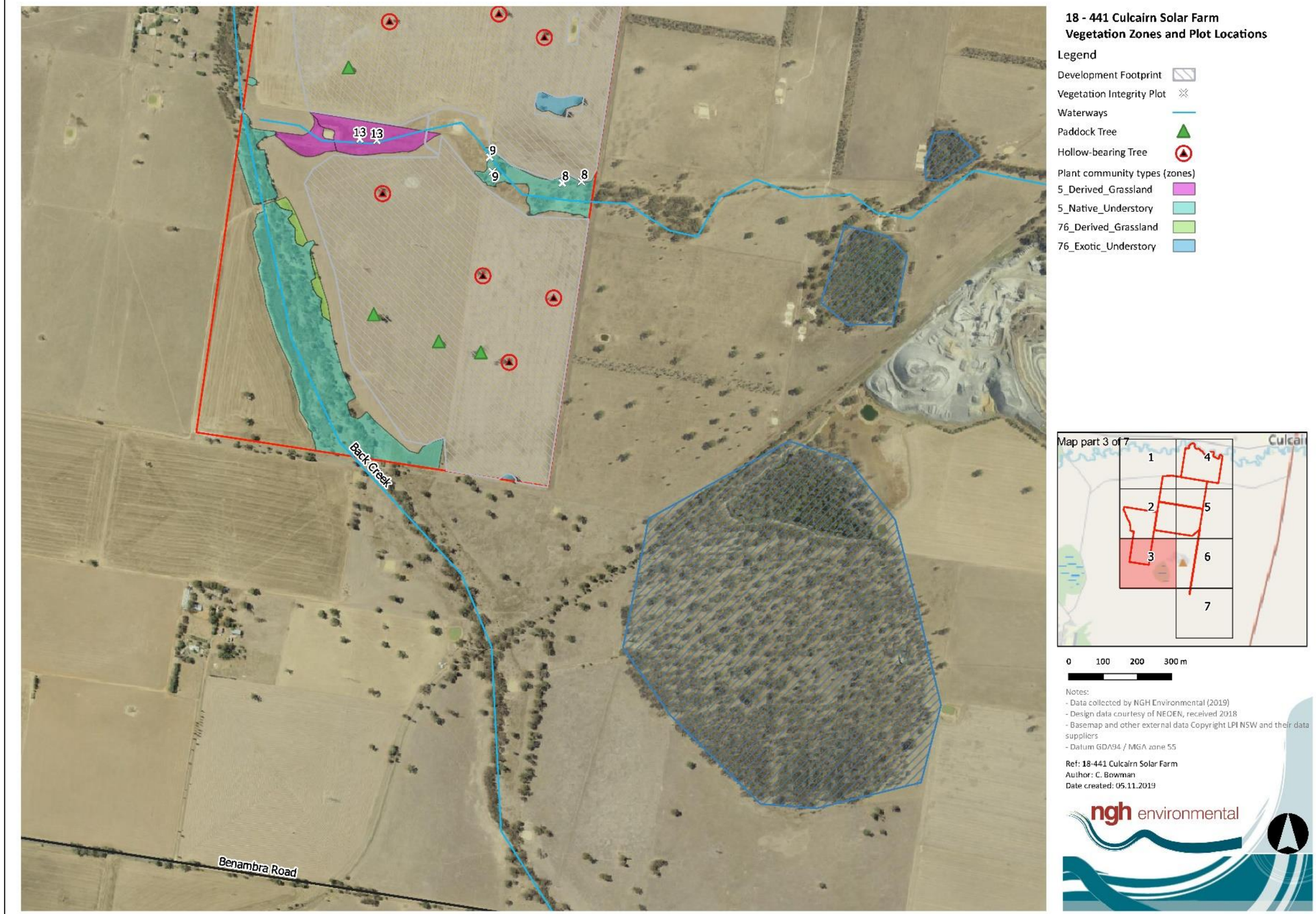


Figure 3-21 Vegetation zones at the development site

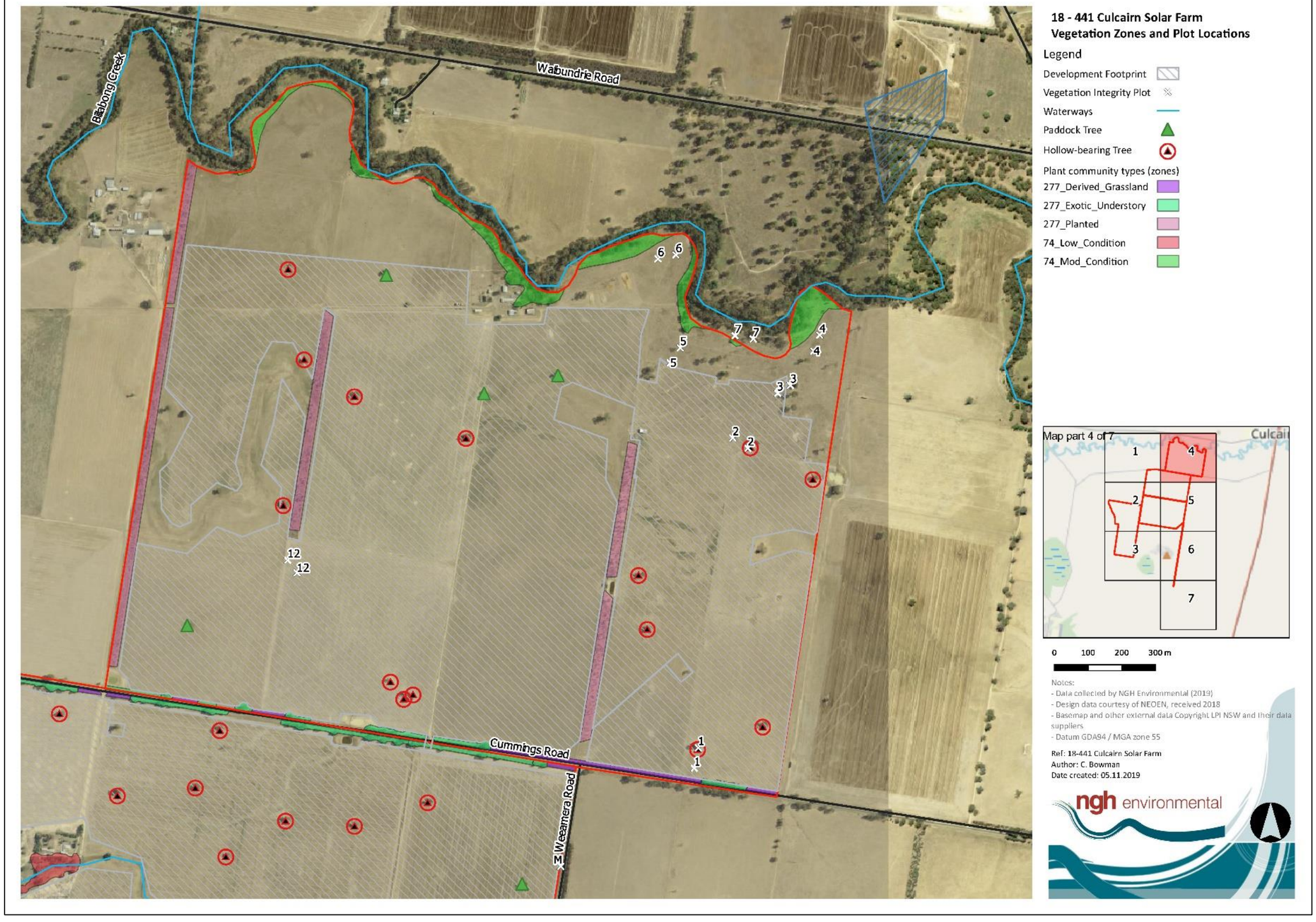
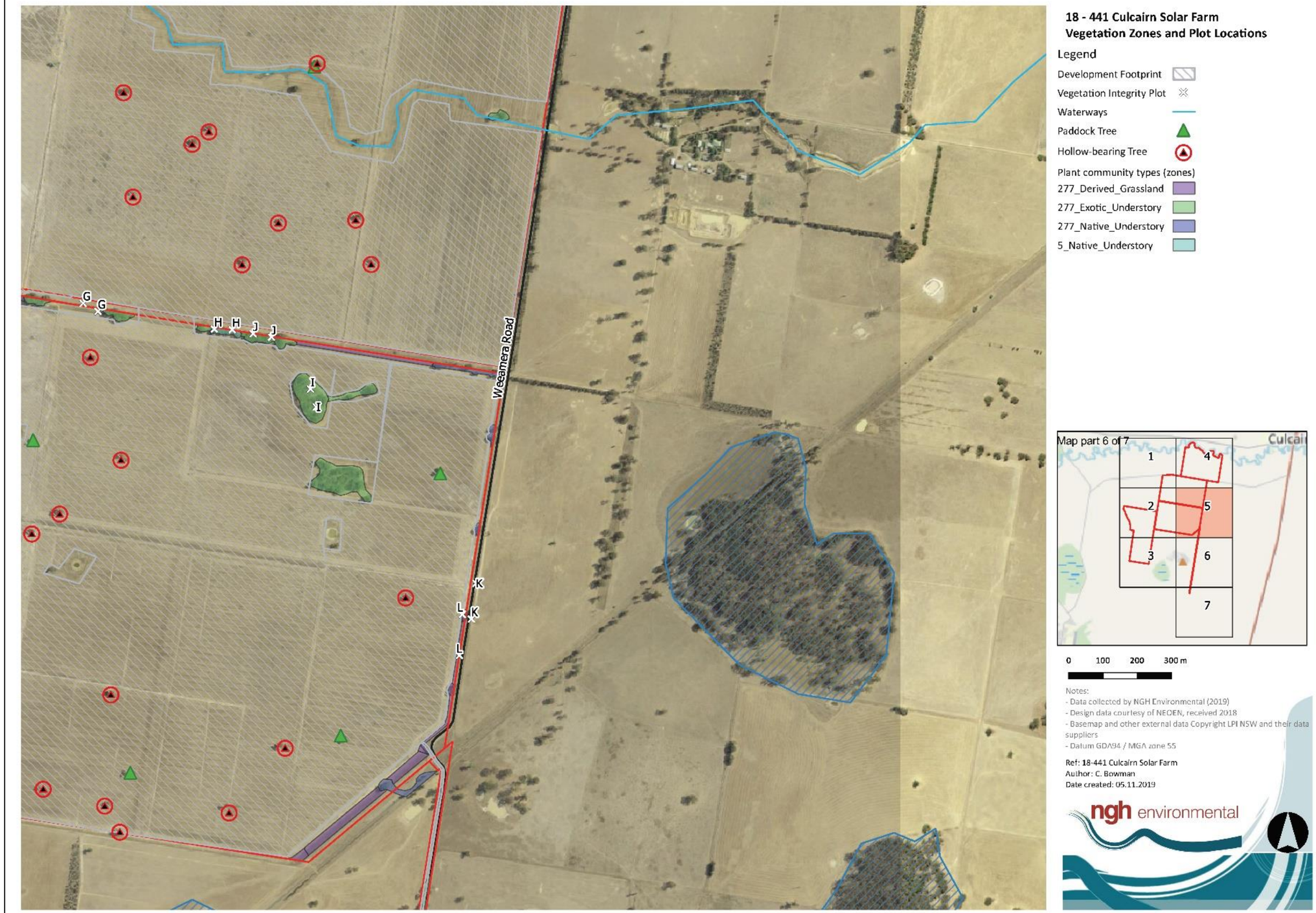


Figure 3-22 Vegetation zones at the development site



18 - 441 Culcairn Solar Farm
Vegetation Zones and Plot Locations

Legend

- Development Footprint
- Vegetation Integrity Plot
- Waterways
- Paddock Tree
- Hollow-bearing Tree

Plant community types (zones)

- 277_Derived_Grassland
- 277_Exotic_Understory
- 277_Native_Understory
- 5_Native_Understory

0 100 200 300 m

Notes:
- Data collected by NGH Environmental (2019)
- Design data courtesy of NECEN, received 2018
- Basemap and other external data Copyright LPI NSW and their data suppliers
- Datum GDA94 / MGA zone 55

Ref: 18-441 Culcairn Solar Farm
Author: C. Bowman
Date created: 05.11.2019

ngh environmental

Figure 3-23 Vegetation zones at the development site

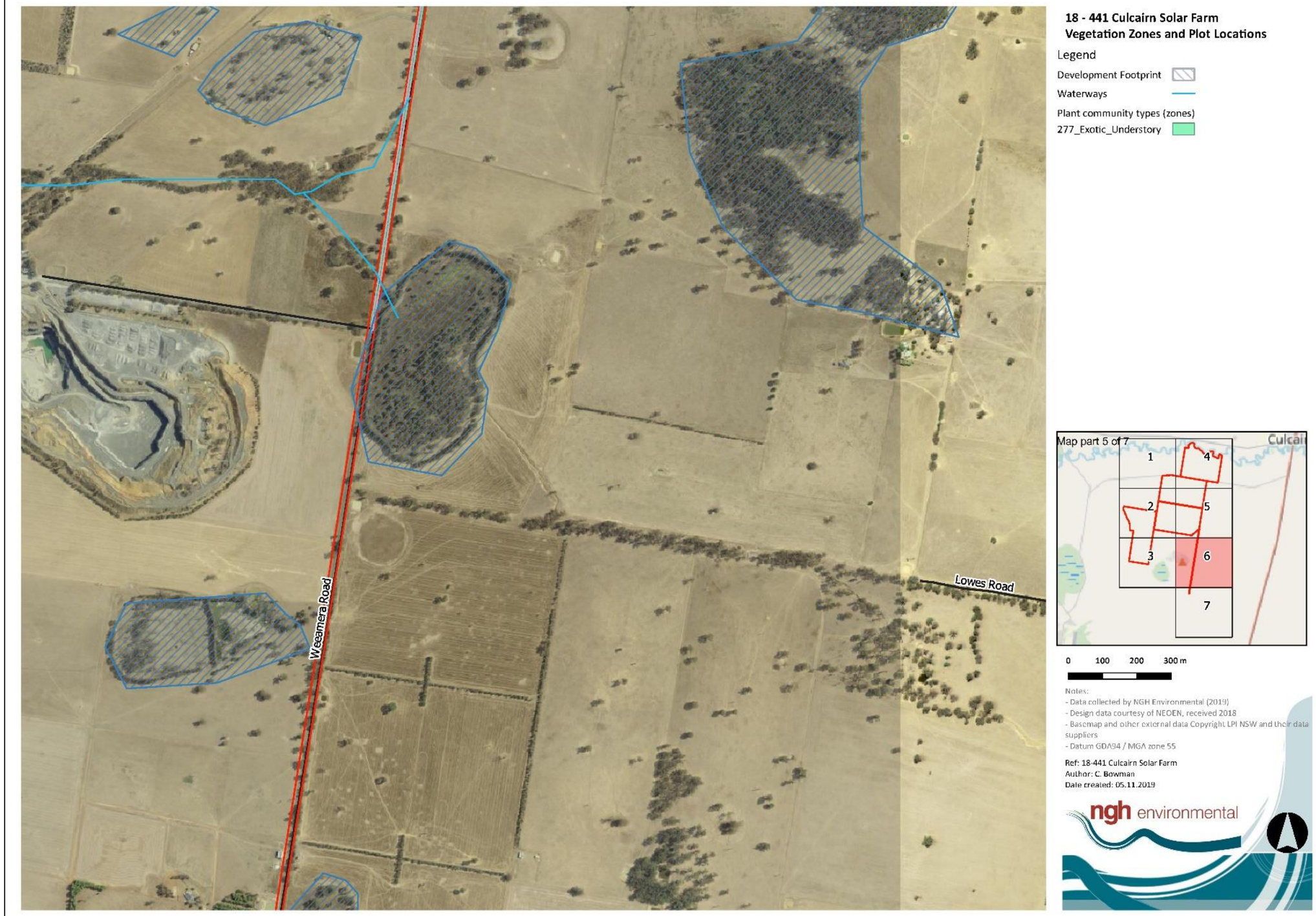


Figure 3-24 Vegetation zones at the development site

Figure 3-25 Vegetation zones at the development site

1.1.2 Paddock Trees

Ninety-nine (99) paddock trees including seventy-one (71) hollow bearing trees occur within the development site. All of these are located within exotic vegetation (cropped/grazed areas). The paddock trees are a mix of mainly Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), and Blakely's Red Gum (*E. blakelyi)*.

The Grey Box paddock trees are most likely remnant of the surrounding Grey Box tall Grassy woodland identified in the development site. As such, PCT 76 was assigned to the paddock trees comprised of Grey Box.

The Blakely's Red Gum and Yellow Box paddock trees are most likely remnant of the Blakely's Red Gum - Yellow Box grassy tall woodland identified in the development zone. As such, PCT277 was assigned to the Paddock Trees comprised of Yellow Box and Blakely's Red Gum.

Threatened species that would use the paddock trees are assumed to be the same threatened species that are returned by the BAM Calculator for the vegetation zones. Where targeted fauna surveys were required for the BAM Calculations, paddock trees were also included in the surveys. Assessments of threatened species that would use the paddock trees as habitat has been incorporated into this BDAR under sections 4 and 5.

Paddock trees were mapped in the field using a handheld GIS Tablet. Trees were identified to genus and species. The Diameter at Breast Height (DBH) of the tree was assessed and assigned a paddock tree class relevant to the large tree benchmark. The large tree benchmark for PCT277 and PCT 76 is 50 cm DBH. The trees were visually assessed from the ground to determine whether any hollows were present. Examples of paddock trees occurring in the development site are shown in Figure 3-7 and listed in Appendix C.

A number of trees were not able to be inspected due to access constraints during surveys. These trees were mapped as the most likely species, and assigned the highest class (3) within the calculator, so as to provide a worst-case scenario during the generation of credits.

Figure 3-26 Paddock trees within the development site

1.1.3 Vegetation integrity assessment results

98 plant species were identified within the 26 vegetation integrity survey plots comprising 39 native species and 59 exotic species. The results of the plot field data can be found in Appendix B.

The plot data from the vegetation integrity survey plots was entered into the BAM calculator by an accredited assessor. The results of the vegetation integrity assessment are provided in Table 3-7.

Table 3-7 Current vegetation integrity scores for each vegetation zone within the development site.

Zone ID	Zone Description	Patch Size	Composition score	Structure score	Function score	Vegetation Integrity Score
	5_Native_Understory	101	32.7	14.7	44.8	**27.8**
	5_Derived_grassland	101	65.5	1.7	6.9	**9.2**
	74_low_condition	3	No plot data – not within development footprint			
	74_mod_condition	101	25.3	44.4	48.6	**37.9**
	76_derived_grassland	5	52.4	41.5	3	**18.6**
	76_exotic_understory	3	3.6	37.8	42.3	**18**
	76_native_understory	1	No plot data – not within development footprint			
	249_native_understory	5	18.3	37.3	9.3	**18.5**
3	277_derived_grassland	5	31.5	46.8	11.9	**26**
1	277_exotic_understory	15	14.4	30.5	76.1	**32.3**
2	277_native_understory	5	41.2	53.9	50.1	**48.1**
	277_planted	3	No plot data – not within development footprint			
	277_regeneration	10	13.8	43.6	63.9	33.7

4 THREATENED SPECIES

4.1 ECOSYSTEM CREDIT SPECIES

The following ecosystem credit species were returned by the ecosystem and paddock tree calculator as being associated with the PCTs present on the development site:

Table 4-1 Ecosystem credit species.

Species	Associated PCT	NSW Listing Status	National Listing Status
Fauna			
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Barking Owl *Ninox connivens* (Foraging)	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Brolga *Grus rubicunda*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Spotted Harrier *Circus assimilis*	PCT 76 – Western Grey Box tall grassy woodland	Not listed	Not listed
Diamond Firetail *Stagonopleura guttata*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Dusky Woodswallow *Artamus cyanopterus cyanopterus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Flame Robin *Petroica phoenicea*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed

Species	Associated PCT	NSW Listing Status	National Listing Status
Gang-gang Cockatoo *Callocephalon fimbriatum*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Glossy Black Cockatoo *Calyptorhynchus lathami*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Grey Falcon *Falco hypoleucos*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Grey-headed Flying-fox *Pteropus poliocephalus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Vulnerable
Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Koala *Phascolarctos cinereus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
Little Lorikeet *Glossopsitta pusilla*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Little Pied Bat *Chalinolobus picatus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Little Eagle *Hieraaetus morphnoides*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Masked Owl *Tyto novaehollandiae*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed

Species	Associated PCT	NSW Listing Status	National Listing Status
Major Mitchell's Cockatoo *Lophochroa leadbeateri* (Foraging)	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Painted Honeyeater *Grantiella picta*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
Regent Honeyeater *Anthochaera phrygia*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Critically Endangered	Critically Endangered
Scarlet Robin *Petroica boodang*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Speckled Warbler *Chthonicola sagittata*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Spotted Harrier *Circus assimilis*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Square-tailed Kite Lophoictinia isura	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Superb Parrot *Polytelis swainsonii*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
Swift Parrot *Lathamus discolor*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Endangered	Critically Endangered
Turquoise Parrot *Neophema pulchella*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Varied Sittella *Daphoenositta chrysoptera*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed

Species	Associated PCT	NSW Listing Status	National Listing Status
White-bellied Sea-eagle *Haliaeetus leucogaster*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed

4.1.1 Species excluded from the assessment

The Golden Sun Moth and Striped Legless Lizard were both excluded from survey as the development site is outside their geographic range.

No other ecosystem credit species were excluded from the assessment; all may occur and contribute to ecosystem credits.

4.2 SPECIES CREDIT SPECIES

4.2.1 Candidate species to be assessed

The BAM Calculator predicted the following species credit species to occur at the development site (Table 4-2);.

Table 4-2 Candidate species credit species requiring assessment

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
Fauna					
Bush Stone-curlew *Burhinus grallarius*	Open forests and woodlands with a sparse, grassy ground layer and fallen timber. Known in subregion.	High	Endangered	Lot listed	Included
Eastern Pygmy-possum *Cercartetus nanus*	Broad range of habitat from rainforest through sclerophyll forest and woodland to heath, but in most areas woodlands and heath preferred. Known in subregion.	High	Vulnerable	Not listed	Included
Gang-gang Cockatoo *Callocephalon fimbriatum*	In spring and summer, tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, lower altitudes in drier, more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages. Known in subregion.	High (breeding) / Moderate (foraging)	Vulnerable	Not listed	Included
Grey-headed Flying-fox *Pteropus poliocephalus*	Range of vegetation communities including rainforest, open forest, and closed and open woodland. Roost sites usually near water, including lakes, rivers, and coastlines. Known to roost in locality.	High	Vulnerable	Vulnerable	Included
Koala *Phascolarctos cinereus*	Temperate, subtropical and tropical eucalypt woodlands and forests where suitable food trees grow, of which there are more than 70 eucalypt species and 30 non-eucalypt species	High	Vulnerable	Not listed	Included

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
	that are particularly abundant on fertile clay soils. Known in subregion.				
Little Eagle *Hieraaetus morphnoides* (Breeding)	Open eucalypt forest, woodland, or open woodland, and Sheoak or Acacia woodlands and riparian woodlands in interior NSW, where they nest in tall living trees within a remnant patch. Known in subregion.	Moderate	Vulnerable	Not listed	Included
Large-eared Pied Bat *Chalinolobus dwyeri*	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves. Found in well timbered areas containing gullies.	Very High	Vulnerable	Vulnerable	Excluded
Masked Owl *Tyto novaehollandiae* (Breeding)	Dry eucalypt forests and woodlands from sea levels to 1100 m. Hunts along the edges of forests, including roadsides. Known in subregion.	High	Vulnerable	Not listed	Included
Pink-tailed Legless Lizard *Aprasia parapulchella*	Inhabits sloping, open woodland areas with predominantly native grassy groundcover, particularly those dominated by Kangaroo Grass. Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks	High	Vulnerable	Vulnerable	Excluded
Regent Honeyeater	Temperate woodlands and open forests of the inland slopes of south-east Australia, in particular dry open forest, woodland, Box-	High	Critically Endangered	Critically Endangered	Included

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
Anthochaera phrygia (Breeding)	Ironbark woodland, and riparian forests of River Sheoak.				
Square-tailed Kite *Lophoictina isura*	Timbered habitats including dry woodlands and open forests, particularly timbered watercourses. Known in subregion.	Moderate	Vulnerable	Not listed	Included
Squirrel Glider *Petaurus norfolcensis*	Old growth box, box-ironbark woodlands, and River Red Gum forests west of the Great Dividing Range. Abundant tree hollows required for refuge and nesting. Known in subregion.	High	Vulnerable	Not listed	Included
Superb Parrot *Polytelis swainsonii* (Breeding)	Box-Gum, Box-Cypress, and Boree Woodlands and River Red Gum Forests. They nest in hollows of large trees in tall open forest or woodland. Recorded on site during survey.	High (breeding) / Moderate (foraging	Vulnerable	Vulnerable	Included
Swift Parrot *Lathamus discolor*	On the coast and southwest slopes in areas with abundant flowering eucalypts or lerp. Feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box. Known in subregion.	Moderate	Endangered	Critically Endangered	Included
White-bellied Sea-Eagle *Haliaeetus morphnoides*	Large areas of open water including larger rivers, swamps, lakes, and the sea. Coastal dunes, tidal flats, grassland, heathland, woodland, and forest. Breeding habitat mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest	High	Vulnerable	Not listed	Included

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
(Breeding)	close to foraging habitat. Known in subregion.				
Flora					
Ausfeld's Wattle *Acacia ausfeldii*	Associated species include Eucalyptus albens, E. blakelyi and Callitris spp., with an understorey dominated by Cassinia spp. and grasses. Known in subregion.	High	Vulnerable	Not listed	Included
Small Scurf-pea *Cullen parvum*	Found in grassland, river Red Gum Woodland or Box-gum Woodland, sometimes on grazed land and usually on table drains or adjacent to drainage lines or watercourses.	High	Endangered	Not Listed	Included
Small Purple-pea *Swainsona recta*	Predominantly grassy woodlands, but sometimes extends into grassy open forest, usually with tree cover including Blakely's Red Gum, Yellow Box, and White Box. Known in subregion.	Moderate	Not listed	Endangered	Included
Silky Swainson-pea *Swainsona sericea*	Box-gum woodland in southern tablelands and South West Slopes. Sometimes in association with cypress pines. Known in subregion.	High	Vulnerable	Not listed	Included

4.2.2 Exclusions based on habitat features

The following species credit species have been excluded from further assessment based on the habitat features absent at the development site.

Table 4-3 Species credit species excluded based on absent habitat features

Credit species	Typically found in well-drained areas with rocky outcrops dominated by Kangaroo Grass.	Habitat Components and abundance on site
Pink-tailed Legless Lizard *Aprasia parapulchella*	Typically found in well-drained areas with rocky outcrops dominated by Kangaroo Grass.	No rocky outcrops on development site
Large-eared Pied Bat *Chalinolobus dwyeri*	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves. Found in well timbered areas containing gullies.	No cliffs, caves or other habitat components on or near development site

4.2.3 Inclusions based on habitat features

A known record of the Sloane's Froglet (*Crinia sloanei*) occurs 1km of the development site (Bionet, 2019). The Sloane's froglet habitat include periodically inundated areas in grassland, woodland and disturbed habitats. Habitat constraints listed in the Threatened Species Database collection include areas within 500m of waterbodies, swamps and wet areas containing relatively shallow sections with submergent and emergent vegetation. The 20 farm dams within the development site are considered suitable habitat for the Sloane's Froglet and this species was added to the BAM Calculator as a candidate species requiring further assessment.

An assessment was undertaken of species associated with the Plant Community Types not within the development footprint but occurring within the development site. PCT 5, 74, 76 and PCT 249 were assessed in the BAM Calculator to determine species credits associated with these PCTs. Species that are mobile that could also utilise the adjacent vegetation within the development footprint were then added to the BAM calculator as candidate species requiring targeted surveys. These species were;

- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Barking Owl (*Ninox connivens*)
- Glossy Black Cockatoo (*Calyptorhynchus lathami*)
- Major Mitchell Cockatoo (*Lophochroa leadbeateri*)
- Southern Bell Frog (*Litoria raniformis*)

4.2.4 Candidate species requiring confirmation of presence or absence

The species listed in Table 4-4 are those that are considered to have habitats present at the development site. Three of these species are assumed to be present on the site. Surveys have been conducted for the remaining species. The results are summarised in Table 4-4. Details of the survey methodologies and results are provided for each surveyed species in section 4.2.5 below. Species polygons have been defined for the species present on the site as mapped on Figure 4-1 to Figure 4-7.

Table 4-4 Summary of species credit species surveyed at the development site

Species credit species	Biodiversity risk rating	Survey period	Assumed to occur/survey/expert report	Present on site?	Species polygon area or count
FAUNA					
Bush Stone-curlew *Burhinus grallarius*	2.00	Jan-Dec	Surveyed November 2018	No	0
Brush-tailed Phascogale *Phascogale tapoatafa*	2.00	Jan - Dec	Surveyed November 2018	No	0
Barking Owl *Ninox connivens*	2.00	May - Dec	Surveyed November 2018	No	0
Eastern Pygmy Possum *Cercartetus nanus*	2.00	Oct-Mar	Surveyed November 2018	No	0
Gang-gang Cockatoo *Callocephalon fimbriatum*	2.00	Oct-Jan	Surveyed November 2018	No	0
Glossy Black Cockatoo *Calyptorhynchus lathami*	2.00	Mar - Aug	Surveyed August 2018	No	0
Grey-headed Flying-fox *Pteropus poliocephalus*	2.00	Oct - Dec	Surveyed November 2018	No	0
Koala *Phascolarctos cinereus*	2.00	Any	Surveyed November 2018	No	0
Little Eagle *Hieraaetus morphnoides*	1.50	Aug - Oct	Surveyed August 2019	No	0
Major Mitchell Cockatoo *Lophochria leadebeateri*	2.00	Sept - Dec	Surveyed November 2018	No	0

Species credit species	Biodiversity risk rating	Survey period	Assumed to occur/survey/expert report	Present on site?	Species polygon area or count
Masked Owl ***Tyto*** *novaehollandiae*	2.00	May-Aug	Surveyed August 2019	No	0
Regent Honeyeater *Anthochaera phrygia*	3.00	Sep-Dec	Surveyed November 2018	No	0
Southern Bell Frog *Litoria raniformis*	2.00	Oct - Jan	Surveyed December 2018	No	0
Sloane's Froglet *Crinia sloanei*	1.50	Jul-Aug	Surveyed August 2019	No	0
Square-tailed Kite *Lophoictinia isura*	1.50	Sep-Jan	Surveyed November 2018	No	0
Squirrel Glider *Petaurus norfolcensis*	2.00	Any	Surveyed November 2018	No	0
Superb Parrot *Polytelis swainsonii*	2.00	Sep-Nov	Surveyed November 2018	No	0
Swift Parrot *Lathamus discolor*	3.00	May-Aug	Surveyed August 2019	No	0
White-bellied Sea-eagle *Haliaeetus leucogaster*	2.00	Jul - Dec	Surveyed November 2018	No	0
FLORA					
Ausfeld's Wattle *Acacia ausfeldii*	2.00	Any	Surveyed November 2018	No	0
Small Scurf-pea *Cullen parvum*	2.00	Dec - Jan	Surveyed December 2018- Assumed present along Weeamera Road	Assumed Present	0.61ha
Silky Swainson-pea *Swainsona sericea*	2.00	Sep-Feb	Surveyed November 2018- Assumed present along Weeamera Road	Assumed present	0.61 ha
Small Purple-pea *Swainsona recta*	2.00	Sept-Nov	Surveyed November 2018- Assumed present along Weeamera Road	Assumed present	0.61ha

4.2.5 Species survey methods

Nocturnal Mammals: Eastern Pygmy Possum, Squirrel Glider, Grey-headed Flying-fox, Brush-tailed Phascogale

SURVEY EFFORT

A targeted spotlight survey was completed on the evenings of the 28, 29 and 30th of November 2018 for a total of approximately 12 person hours. A 100-watt spotlight was used for both vehicle-based and foot surveys of planted vegetation, remnant vegetation, and isolated paddock trees. This involved visual searches of trees for arboreal mammals and call playback surveys for Squirrel Glider. Visual searches in the canopy for Grey-headed Flying-foxes during vehicle-based and foot searches were also undertaken. Vehicle-based searches were undertaken for approximately 6 person hours, and foot surveys for 6 person hours. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 24.8°C, maximum temperature of 29.0°C, and 0.0 mm of rainfall.

SURVEY RESULTS

No nocturnal mammals, including Eastern Pygmy-possums, Squirrel Gliders, Brush tailed Phascogales, and Grey-headed Flying-foxes, were seen during the survey. No flying fox breeding camps were observed within the development site.

Sloane's Froglet and Southern Bell Frog

SURVEY EFFORT

A targeted frog survey for the the Southern Bell Frog was completed on the nights of 18th and 19th of December 2018 for a total of approximately 8 person hours (2 hours per night per species). Weather conditions recorded for these days at the nearest weather station included a minimum and maximum temperature of 33.2°C and 0.0 mm of rainfall. Survey included call playback and nocturnal surveys at the dams.

A targeted frog survey for the Sloane's Froglet was conducted on the nights of 12th and 13th of August 2019. Survey included call playback at the dams. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 11.6°C, maximum temperature of 12.3°C, and 0.0 mm of rainfall

SURVEY RESULTS

No Sloane's Froglets, Southern Bell Frogs, or Booroolong frogs were seen or heard during the survey.

All surveys were conducted within the respective ideal survey periods outlined.

Nocturnal Birds: Barking Owl, Masked Owl & Bush-stone Curlew

SURVEY EFFORT

A targeted species was completed on the nights of 28th and 29th of November 2018 for Barking Owl and Bush Stone Curlew for a total of approximately 8 person hours (2 hours per night per species). Call playback with a megaphone was used from the vehicle along planted vegetation, remnant vegetation, and isolated paddock trees, followed by a period of listening for responses. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 24.8°C, maximum temperature of 29.0°C and 0.0 mm of rainfall.

A targeted species survey was conducted on the nights of 12th and 13th August 2019 for the Masked Owl. Survey method included call play back through the megaphone and spotlighting using the 100-watt spotlight.

SURVEY RESULTS

No threatened birds were seen or heard during the survey.

The surveys occurred during the respective survey periods for all threatened nocturnal birds.

Koala

SURVEY EFFORT

A targeted search was completed on the nights of the 28th and 29th November 2018 for a total of 4 hours (2 person hours per night). Survey methods included a spotlight search. Weather conditions recorded at the nearest weather station included minimum temperature 24.8°C, maximum temperature of 29.0°C and 0.0 mm of rainfall.

SURVEY RESULTS

No Koalas were seen during the survey.

Woodland Birds: Regent Honeyeater, Gang-Gang Cockatoo, Major Mitchell Cockatoo, Superb Parrot, Swift Parrot, White Bellied Sea Eagle, Square-tailed Kite, Glossy Black Cockatoo, Little Eagle.

SURVEY EFFORT

A woodland bird census was completed on the mornings of the 27th – 30th of November 2018. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 24.8°C, maximum temperature of 29.0°C, and 0.0 mm of rainfall. Four 20-minute point surveys for birds were carried out over two days, as well as opportunistic surveys throughout the site visit including traversing the site by car and on foot. Paddock trees and remnant trees were surveyed for evidence of stick nests used by raptors. Hollow-bearing tree mapping was undertaken within November and December and included inspection of all trees on site during the breeding period of the Superb Parrot.

A targeted search for the remaining woodland bird species (Glossy Black Cockatoo, Little Eagle, Swift Parrot) was conducted on the 12th, 13th and 14th of August 2019. Survey effort included diurnal bird surveys and stag watching in the evening.

SURVEY RESULTS

No threatened bird species were observed during the survey effort. All surveys occurred during the correct survey periods for all threatened birds.

Threatened Forbs and Grasses: Small Purple Pea, Silky Swainson-pea and Small Scurf-pea,

SURVEY EFFORT

Targeted flora transects were undertaken of the woodland and grassland areas at 10 m intervals in accordance with the NSW Guide to Surveying Threatened Plants (OEH, 2016) from 27th to 30th November 2018 and 18th to 20th December 2018.

SURVEY RESULTS

No threatened forbs or grasses were detected within the survey area. Silky Swainson Pea, Small Purple Pea and Small Scurf pea were unable to be surveyed during the correct survey period along Weeamera road and were assumed to be present along this road.

Threatened shrubs: Ausfeld's Wattle

SURVEY EFFORT

Suitable habitat for this species could occurred throughout the whole site between the 12th to 14th August 2018.

SURVEY RESULTS

Ausfeld's Wattle was not detected during the site surveys. Only one Wattle species; Hickory Wattle, was detected during targeted searches.

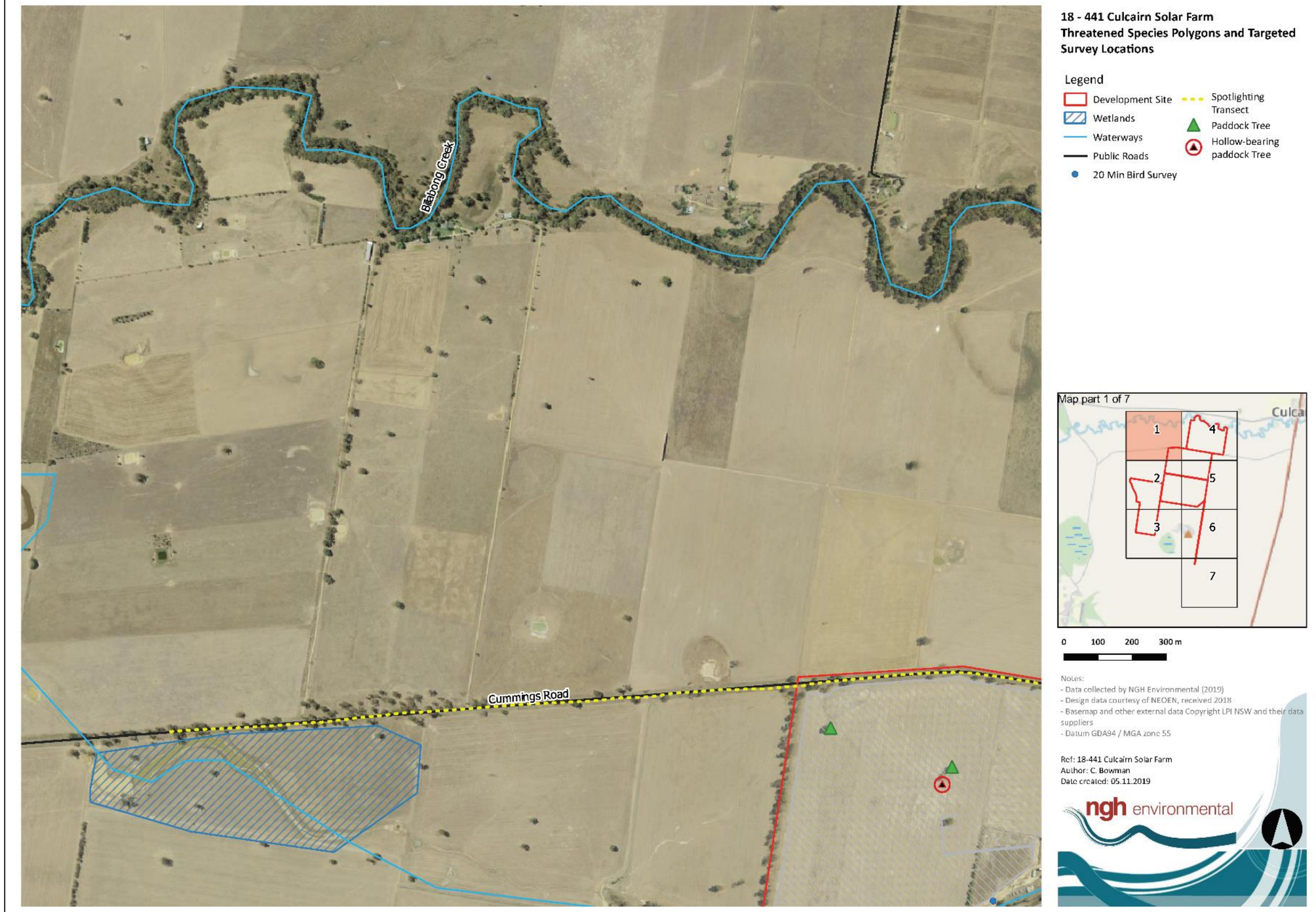


Figure 4-1 Threatened species polygons and targeted survey locations

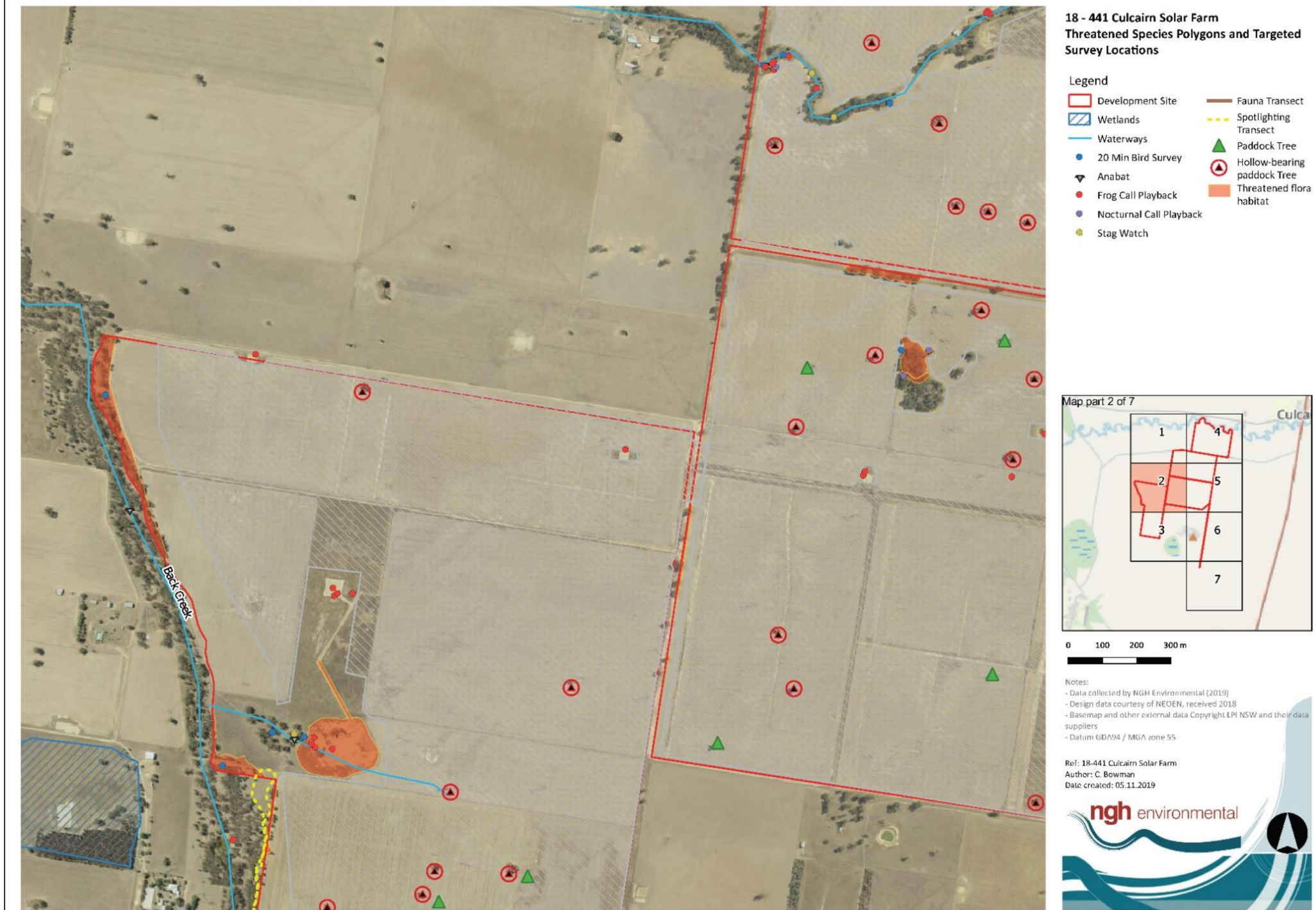
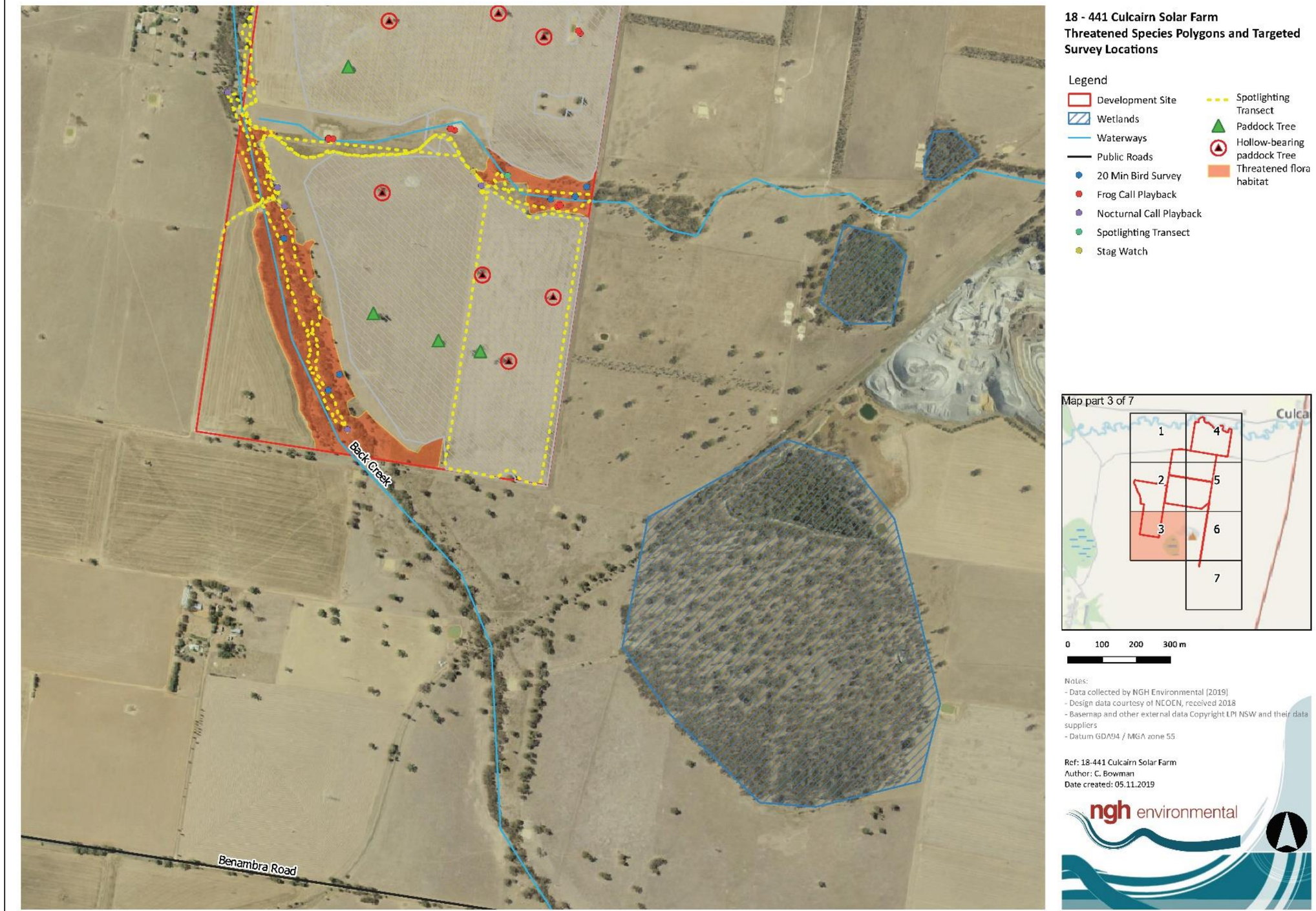


Figure 4-2 Threatened species polygons and targeted survey locations



18 - 441 Culcairn Solar Farm
Threatened Species Polygons and Targeted Survey Locations

Legend

- Development Site
- Wetlands
- Waterways
- Public Roads
- 20 Min Bird Survey
- Frog Call Playback
- Nocturnal Call Playback
- Spotlighting Transect
- Stag Watch
- Spotlighting Transect
- Paddock Tree
- Hollow-bearing paddock Tree
- Threatened flora habitat

0 100 200 300 m

Notes:
- Data collected by NGH Environmental (2019)
- Design data courtesy of NEOEN, received 2018
- Basemap and other external data Copyright LPI NSW and their data suppliers
- Datum GDA94 / MGA zone 55

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Author: C. Bowman
Date created: 05.11.2019

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Figure 4-3 Threatened species polygons and targeted survey locations

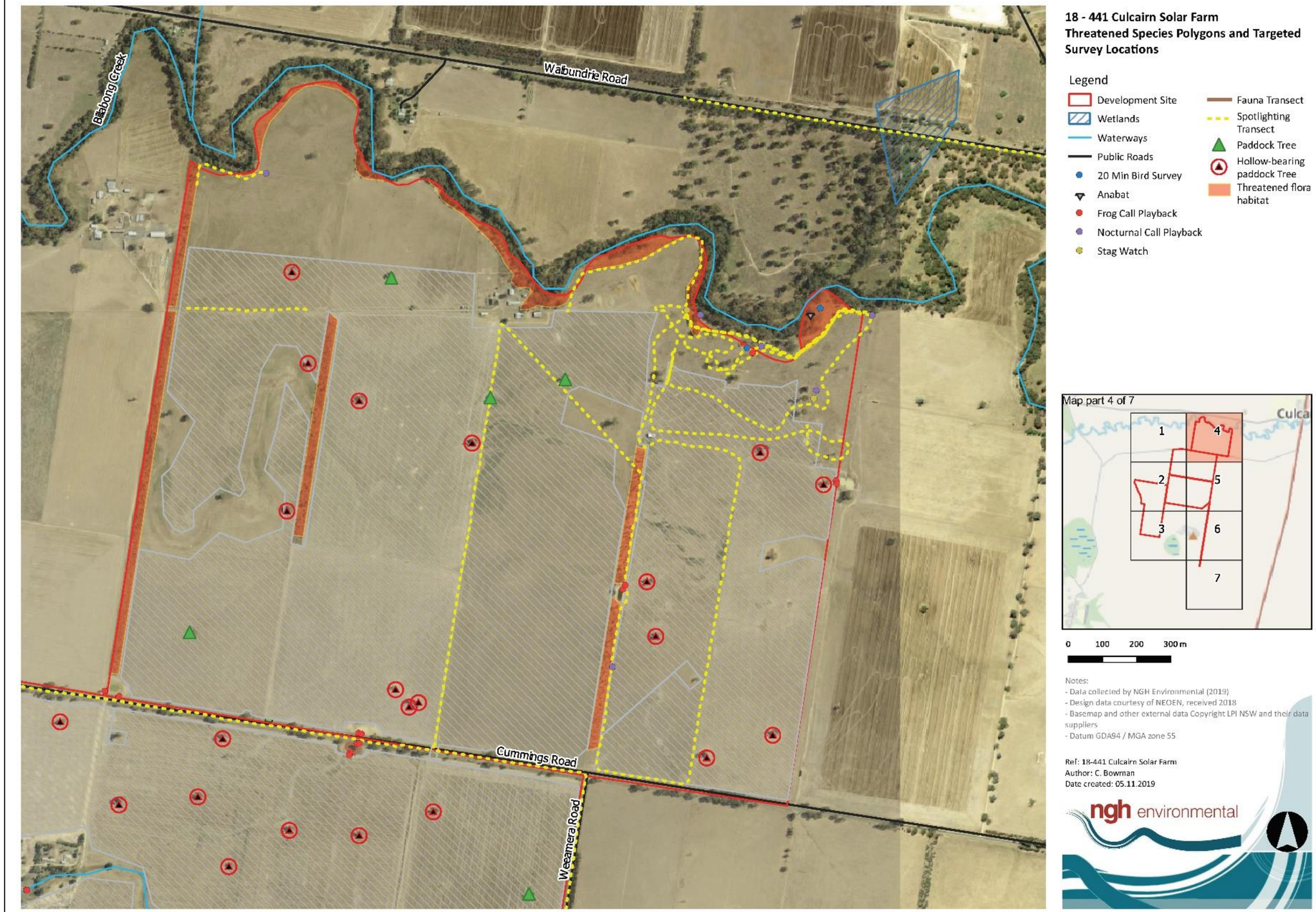
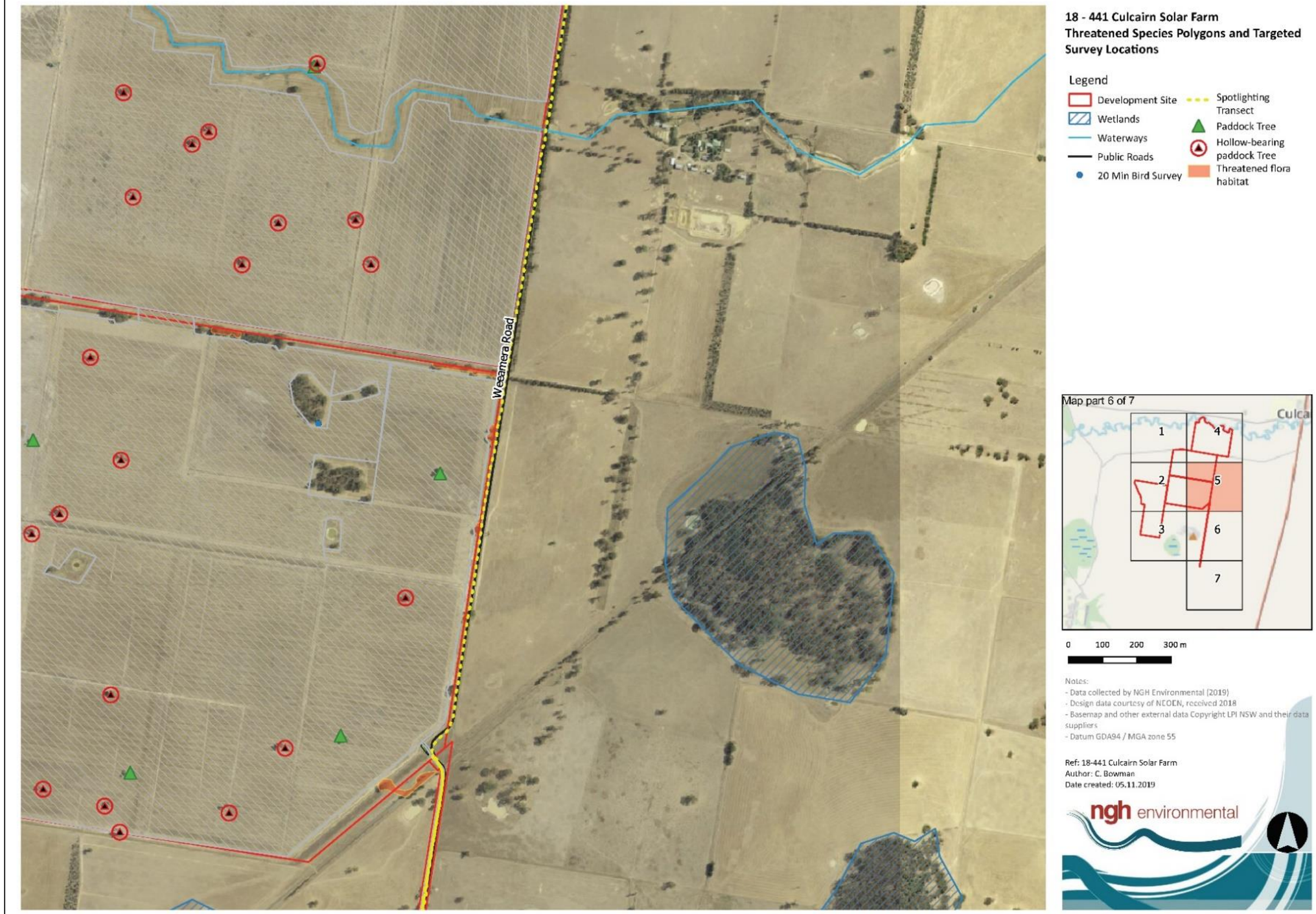


Figure 4-4 Threatened species polygons and targeted survey locations



18 - 441 Culcairn Solar Farm
Threatened Species Polygons and Targeted Survey Locations

Legend

- Development Site
- Wetlands
- Waterways
- Public Roads
- 20 Min Bird Survey
- Spotlighting Transect
- Paddock Tree
- Hollow-bearing paddock Tree
- Threatened flora habitat

0 100 200 300 m

Notes:
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Figure 4-5 Threatened species polygons and targeted survey locations

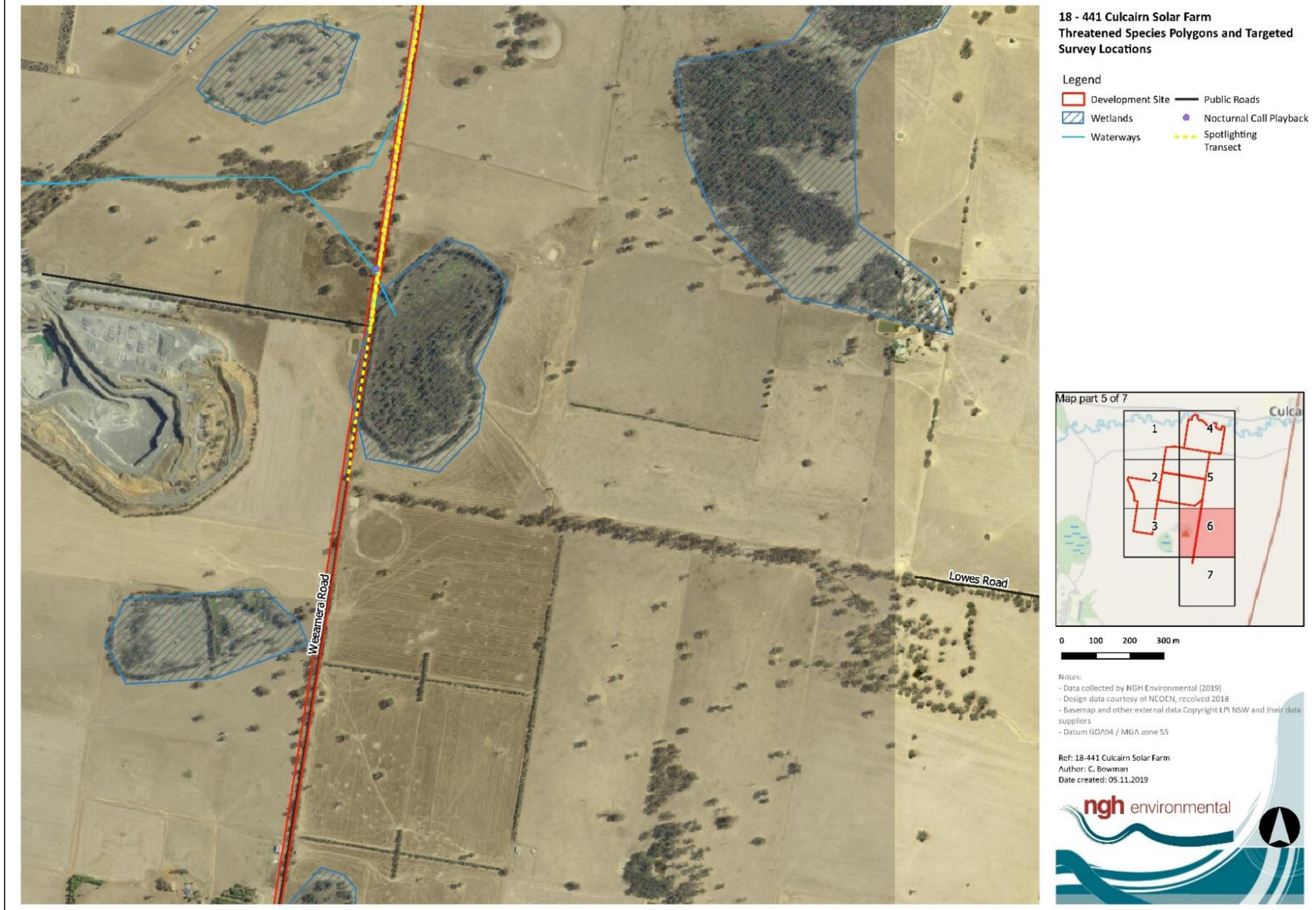

Figure 4-6 Threatened species polygons and targeted survey locations

Figure 4-7 Threatened species polygons and targeted survey locations

4.3 ADDITIONAL HABITAT FEATURES RELEVANT TO PRESCRIBED BIODIVERSITY IMPACTS

4.3.1 Occurrences of karst, caves, crevices and cliffs

As verified by the field inspection, there are no occurrences of karst, caves, crevices, or cliffs in the development site.

4.3.2 Occurrences of rock

As verified by the field inspection, there are no occurrences of surface rock in the development site.

4.3.3 Occurrences of human made structures and non-native vegetation

As verified by the field inspection, there are no human made structures within the development site. Both parcels of land comprising the development site are cleared and currently used for cropping and pasture. The extent of productive agriculture land in the region is considerable and native animals benefiting cleared exotic vegetation environments have ample access to suitable habitat, thus only minimal impact on threatened species is anticipated from the proposal.

4.3.4 Hydrological processes that sustain and interact with the rivers, streams and wetlands

The Back Creek catchment extends into a hill range, 6 km east of the Olympic Highway. The upper catchment area drains westwards crossing the Olympic Highway and flowing north along the western boundary of the development site. The majority of Back Creek catchment has been predominantly cleared for agriculture, with the exception of the steeper hillside areas located in the upper catchment. Back Creek and its tributaries that transect the development site have been excluded from the development footprint.

The headwaters of Billabong Creek begin in the upland areas around Holbrook, NSW. The channel continues westward for approximately 320 km before its confluence with the Edward River at Moulamein, NSW. Billabong Creek borders the northern boundary of the subject land. Billabong Creek and its riparian vegetation have been excluded from the development footprint.

5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC protected matters report was undertaken on 9th August 2019 (10 km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site. Relevant to Biodiversity these include:

- Wetlands of International Importance – 4;
- Threatened Ecological Communities – 3;
- Threatened species – 24; and
- Migratory species – 11.

The potential for these MNES to occur at the site are discussed below.

5.1 WETLANDS OF INTERNATIONAL IMPORTANCE

Four wetlands of international importance were returned from the protected matters report. The nearest of these (within 400 km of the development site) is Hattah-kulkyne lakes. All other wetlands returned from the search are over 500 km away. The Murray River occurs approximately 45 km from the development site, though there is no indication that the proposal will impact the Murray River.

5.2 THREATENED ECOLOGICAL COMMUNITIES

Three threatened ecological communities were returned from the protected matters report.

These include:

- Grey Box (eucalyptus macrocarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
- Weeping Myall Woodlands
- White Box-Yellow Box- Blakey's Red Gum Grassy Woodland and Derived Native Grassland

5.3 THREATENED SPECIES

Twenty-seven threatened species were returned from the EPBC protected matters report. Of these, nine are considered to have the potential to utilise the habitats at the development site:

- Superb Parrot (*Polytelis swainsonii*). - V
- Painted Honeyeater (*Grantiella picta*). – V
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – V
- White-throated Needletail (*Hirundapus caudacutus*) – V
- Swift Parrot (*Lathamus discolor*). - CE
- Regent Honeyeater (*Anthochaera phrygia*). – CE
- Sloane's Froglet (*Swainsona sericea*) - E
- Koala (*Phascolarctos cinereus*) -V
- Small Purple-pea *(Swainsona recta)* - E

5.4 MIGRATORY SPECIES

Eleven listed migratory species were returned from the protected matters report. Two of these species are considered likely to occur at the site on a regular basis or rely on the habitats present. These are;

- Fork-tailed Swift (*Apus pacificus*) - M
- White-throated Needletail (*Hirundapus caudacutus*) - M

6 AVOID AND MINIMISE IMPACTS

6.1 AVOIDING AND MINIMISING IMPACTS ON NATIVE VEGETATION AND HABITAT

6.1.1 Site selection – consideration of alternative locations/routes

During the development of the proposal, a number of alternatives were considered. These include the 'do nothing option' (not developing the solar farm), alternative proposal area locations, and developing different renewable technologies.

During the site selection process for the proposal, the proponent reviewed the solar generation potential of many areas in NSW using a combination of computer modelling and analysis, on the ground surveying, and observation and experience of the proponent. The proposed site was selected because it provides the optimal combination of:

- Low environmental constraints (predominantly cleared cropping and grazing land);
- Level terrain for cost effective construction;
- High quality solar resource;
- Compatible land use zoning (on the development site and considering adjacent land holdings);
- Low flood risk;
- Existing road access;
- Onsite connection to the transmission network;
- High levels of available capacity on the grid transmission system; and
- Land availability and support from the landowner.

The development site is of a scale that allows for flexibility in the design, allowing site constraints identified during the EIS process to be avoided or effectively mitigated.

The design of the proposal is the result of an iterative process. The design has been adapted progressively as information regarding site constraints, and the potential impacts and risks associated with the development of the proposal have become available.

Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall.

Available grid capacity at a suitable voltage on the existing TransGrid Jindera to Wagga Wagga 330 kV transmission line west of the site was also instrumental in making Culcairn an ideal choice for a renewable energy development.

6.1.2 Proposal components – consideration of alternate modes or technologies

The Australian Government's Large-scale Renewable Energy Target (LRET) and NSW Government's Renewable Energy Action Plan (REAP) outline the commitment by both Australia and NSW more specifically to reducing GHG emissions and have set targets for increasing the supply of renewable energy. Other forms of largescale renewable energy accounted for in the LRET include wind, hydro, biomass, and tidal energy. The feasibility of wind, solar, biomass, hydro and tidal projects depend on the availability of energy resources and grid capacity.

PV solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site. Unlike wind farms, which are installed on elevated topography, solar energy farms can be effectively screened by vegetation to reduce the impact of visual disturbance, which would also provide additional habitat for local fauna. Solar energy farms also have few moving parts and are less likely to interfere with bird flight patterns.

Superior solar resources have been identified in NSW, providing excellent opportunities for solar projects.

6.1.3 Proposal planning phase – detailed design

A preliminary constraints analysis was conducted by an NGH Environmental ecologist, which informed the site layout design. Vegetation constituting the highest ecological constraints, such as forming components of EECs and providing habitat for threatened flora and fauna were avoided and minimised as far as practical by amending the configuration of solar panels to avoid the removal of trees present at the project site.

For example:

- reducing the clearing footprint of the project;
- locating ancillary facilities in areas where there are no biodiversity values;
- locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score);
- locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC);
- providing structures to enable species and genetic material to move across barriers or hostile gaps;
- maintaining the landscape to allow surface water to follow existing drainage routes; and
- making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.

The development footprint was updated to avoid clearing of most of the native vegetation patches within the development site. One Threatened Ecological Community, Box-gum Woodland, will be impacted by the development with 0.61 ha falling within the development footprint. The majority of this area is roadside vegetation with minimal to no shrub layer and high weed groundcover incursion.

Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall. The final design avoids the majority of native vegetation, habitat of threatened species and ecological communities.

The development footprint would occupy around 1126 hectares of the 1367 ha subject land. The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar array generating around 400 megawatts (MW) (alternating current (AC)) of renewable energy and would connect into an existing 330 kV TransGrid transmission line that traverses the proposal.

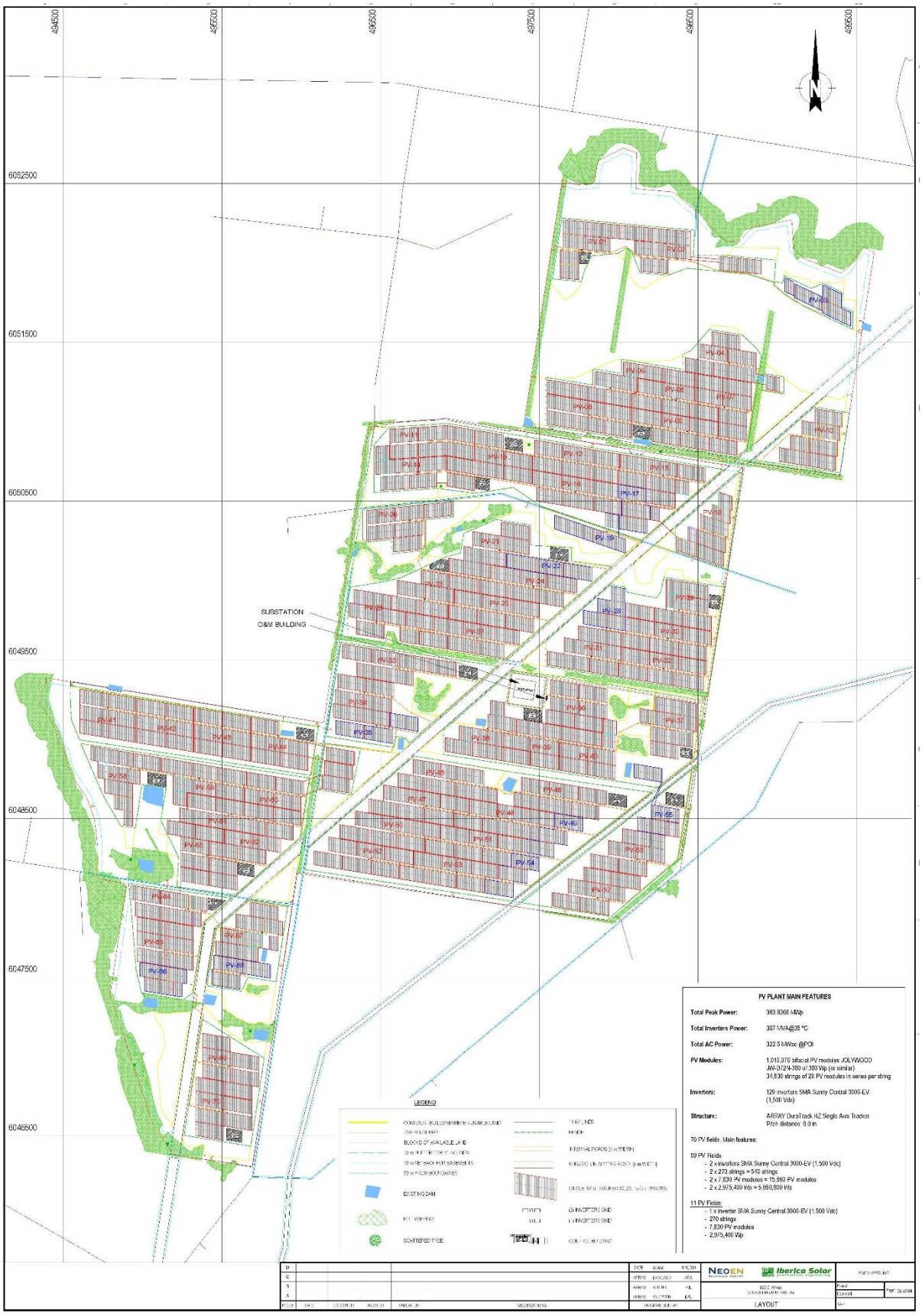

Figure 6-1 Project footprint

6.2 AVOIDING AND MINIMISING PRESCRIBED BIODIVERSITY IMPACTS

The BC Regulation (clause 6.1) identifies actions prescribed as impacts to be assessed under the biodiversity offsets scheme:

a) Impacts of development on the habitat of threatened species or ecological communities associated with:
   i. karst, caves, crevices, cliffs and other geological features of significance, or
   ii. rocks; or
   iii. human made structures; or
   iv. non-native vegetation.
b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range;
c) Impacts of development on movement of threatened species that maintains their life cycle;
d) Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining);
e) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

How these prescribed impacts have been avoided and minimised by the proposal is detailed below.

6.2.1 Impacts of development on the habitat of threatened species or ecological communities associated with human made structures or non-native vegetation.

No karsts, caves, crevices, cliffs or rocky outcrops within the development site.

There are twenty farm dams within the development site. Impacts to all the farm dams would be avoided during construction and the final development footprint.

The current dominant land use at the of the proposal site is agricultural cropping and grazing, with the majority of the proposal area dominated by non-native vegetation. No threatened species are considered to rely on the non-native vegetation within the development site.

6.2.2 Impacts of development on the connectivity of different areas of habitat or threatened species that facilitates the movement of these species across their range.

Connectivity is very limited throughout the development site, consisting of a highly cleared landscape. The main connectivity corridors for threatened species would occur along the vegetated Back Creek and Billabong Creek. These vegetated creek lines have been avoided by the development footprint.

6.2.3 Impacts of development on movement of threatened species that maintain their lifecycle.

The development site is not a known migratory path for threatened species. The main connectivity corridors for threatened species would occur along the vegetated Back Creek and Billabong Creek. These vegetated creek lines have been avoided by the development footprint.

6.2.4 Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities.

The three drainage lines throughout the development site have been avoided by the proposal and will continue to maintain the current hydrological processes.

Twenty farm dams are present within the development site but would be avoided during construction and the final development footprint.

1.1.4 Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

The proposal would not directly increase impacts of vehicle strikes on animals that are part of a TEC. Threatened species would not be funnelled into transport corridors.

7 IMPACTS UNABLE TO BE AVOIDED

7.1 DIRECT IMPACTS

The construction and operational phases of the proposal has the potential to impact biodiversity values at the site that cannot be avoided. This would occur through direct impacts such as habitat clearance and installation and existence of infrastructure.

Table 7-1 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Direct impacts				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	Approximately 0.61 ha of PCT 227 to be impacted by development	Once	Construction	• Direct loss of native flora and fauna habitat • Potential over-clearing of habitat outside proposed development footprint • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock
Removal of paddock trees	99 Trees	Once	Construction Phase: Long Term	• Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Direct Loss of native flora and fauna habitat
Displacement of resident fauna	Unknown	Regular	Construction & Operation Phase: Long Term	• Direct loss of native fauna • Decline in local fauna populations
Injury or death of fauna	Unknown	Regular	Construction Phase: Long Term	• Direct loss of native fauna • Decline in local fauna populations
Removal of habitat features e.g. HBTs	71 HBTs	Regular	Construction Phase: Long Term	• Direct loss of native fauna habitat • Injury and mortality of fauna during clearing of habitat features
Shading by solar infrastructure	787.5 ha (70% of solar array)	Regular	Operational Phase: Long-term	• Modification of native fauna habitat • Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent solar infrastructure (Fencing, array infrastructure).	Total of 1126ha	Regular	Operational Phase: Long-Term	• Modification of habitat beneath array (mostly non-native) • Reduced fauna movements across landscape due to fencing

Nature of impact	Extent	Frequency	Duration and timing	Consequence
				• Collision risks to birds and microbats (fencing).

7.1.1 Changes in vegetation integrity scores

The future value of the attributes may take into account impacts from partial clearing in a vegetation zone. The assessor must provide supporting information in the BAR that specifies how the future value of the attribute and vegetation integrity will be achieved and maintained.

The changes in vegetation integrity scores as a result of vegetation clearing are documented for each vegetation zone in Table 7-2 below.

Zones 277_Exotic_Understory, 277_Native_Understory and 277_Derived Grassland will be impacted through the construction of a widened road and turn in bay. As the detailed design has not been completed for these works, a worst-case scenario has been utilised below whereby all vegetation within the impact footprint is removed permanently.

Table 7-2 Table of current and future vegetation integrity scores for each vegetation zone within the development site.

Zone ID	PCT	TEC and/or threatened species habitat?	Area (ha)	Current vegetation integrity score	Future vegetation integrity score
277_Exotic_Understory	277	Y	0.59	**32.3**	**0**
277_Native_Understory	277	Y	0.01	**48.1**	**0**
277_Derived_Grasland	277	Y	0.01	**26**	**0**

7.1.2 Loss of species credit species habitat or individuals

The loss of species credit species habitat or individuals as a result of clearing is documented in Table 7-3below.

Table 7-3 Summary of species credit species loss at the development site.

Species Credit Species	Biodiversity risk weighting	Area of habitat / count of individuals lost
Silky Swainson-pea *Swainsona sericea*	2.00	0.61 ha (Assumed)
Small Purple-pea *Swainsona recta*	2.00	0.61 ha (Assumed)
Small Scurf-pea *Cullen parvum*	1.50	0.61 ha (Assumed)

7.1.3 Loss of hollow-bearing trees

71 Hollowing bearing trees (HBTs) were recorded within the development footprint and would be removed by the proposal (Table 7-4).

Table 7-4 Hollow Bearing Trees impacted by the proposal.

PCT	Paddock Trees Impacted	HBTs impacted
76	20	13
277	79	58
TOTAL	**99**	**71**

7.2 INDIRECT IMPACTS

Indirect impacts can occur when the proposal or activities relating to the construction or operation of the proposal affect native vegetation, threatened ecological communities or threatened species habitat beyond the development site. Table 7-5 below details the indirect impacts required to be assessed by the BAM.

Table 7-5 Potential impacts on biodiversity during the construction and operational phases.

Nature of impact	Impact	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Indirect impacts (those listed below are included in the BAM)				
Inadvertent impacts on adjacent habitat or vegetation	Possible – Clearing may inadvertently extend into retained vegetation patches	Construction Phase: Short-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• Direct loss of native flora and fauna habitat; • Injury and mortality of fauna during clearing of fauna habitat and habitat trees; • Disturbance to stags, fallen timber; and • Increased edge effects.
Reduced viability of adjacent habitat due to edge effects	Possible- Most retained vegetation is contiguous with vegetation adjacent to the proposal	Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• Loss of connectivity between remnant 277 within and around development footprint; and • Reduced genetic diversity within isolated populations
Reduced viability of adjacent habitat due to noise, dust, heat or light spill	Possible – construction works may impact on habitat quality in retained vegetation	Operational Phase: Short-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• May alter fauna activities and/or movements; • Loss of foraging or breeding habitat; and • Inhibit the function of plant species, soils and dams.
Possible – may be brought in soils or unclean machinery	Construction & Operational Phase: Long-term	Possible – may be brought in soils or unclean machinery	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• Degradation of community biodiversity and integrity; a • Weed encroachment (remnant veg); and • Movement of weeds by water to downstream habitats.
Increased risk of starvation, exposure and loss of shade or shelter	Unlikely – Food sources still available	n/a	• n/a	• n/a

Nature of impact	Impact	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Loss of breeding habitats	71 HBT	Construction Phase: Long-Term	• Hollow-dependent fauna	• Loss of potential breeding habitat including fallen and hollow logs at height
Earthworks and mobilisation of sediments	Possible - loss of groundcover during construction may increase mobilisation of sediments.	Construction Phase – Short Term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• Erosion and sediment deposition pollution on downstream habitats; and • Alternation of surface watercourses (isolating high biodiversity value communities).
Trampling of threatened flora species	Unlikely – no known threatened flora species in adjacent vegetation	n/a	n/a	n/a
Inhibition of nitrogen fixation and increased soil salinity	Unlikely – Ground water table unlikely to change. Majority of site is currently under cropping rotation.	n/a	n/a	n/a
Fertiliser drift	Unlikely – Fertilisers unlikely to be applied.	n/a	n/a	n/a
Rubbish Dumping	Unlikely – Development site will be fenced.	n/a	n/a	n/a
Wood Collection	Unlikely – Development site will be fenced.	n/a	n/a	n/a
Bush rock removal and disturbance	Unlikely – No bush Rock in development site.	n/a	n/a	n/a

Nature of impact	Impact	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Increase in predatory species populations	Possible – additional shelter habitat for predatory invasive species.	Construction & Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland	• Injury and mortality of fauna from predatory species
Increase in pest animal populations	Possible - additional shelter habitat for invasive species.	Construction & Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland	• Injury and mortality of fauna from predatory species • Disturbance to native flora and fauna • Loss of foraging or breeding habitat •
Increased risk of fire	Unlikely – No battery storage in proposal	n/a	• n/a	• n/a
Disturbance to specialist breeding and foraging habitat.	Unlikely – No specialist breeding or foraging habitat.	n/a	• n/a	• n/a

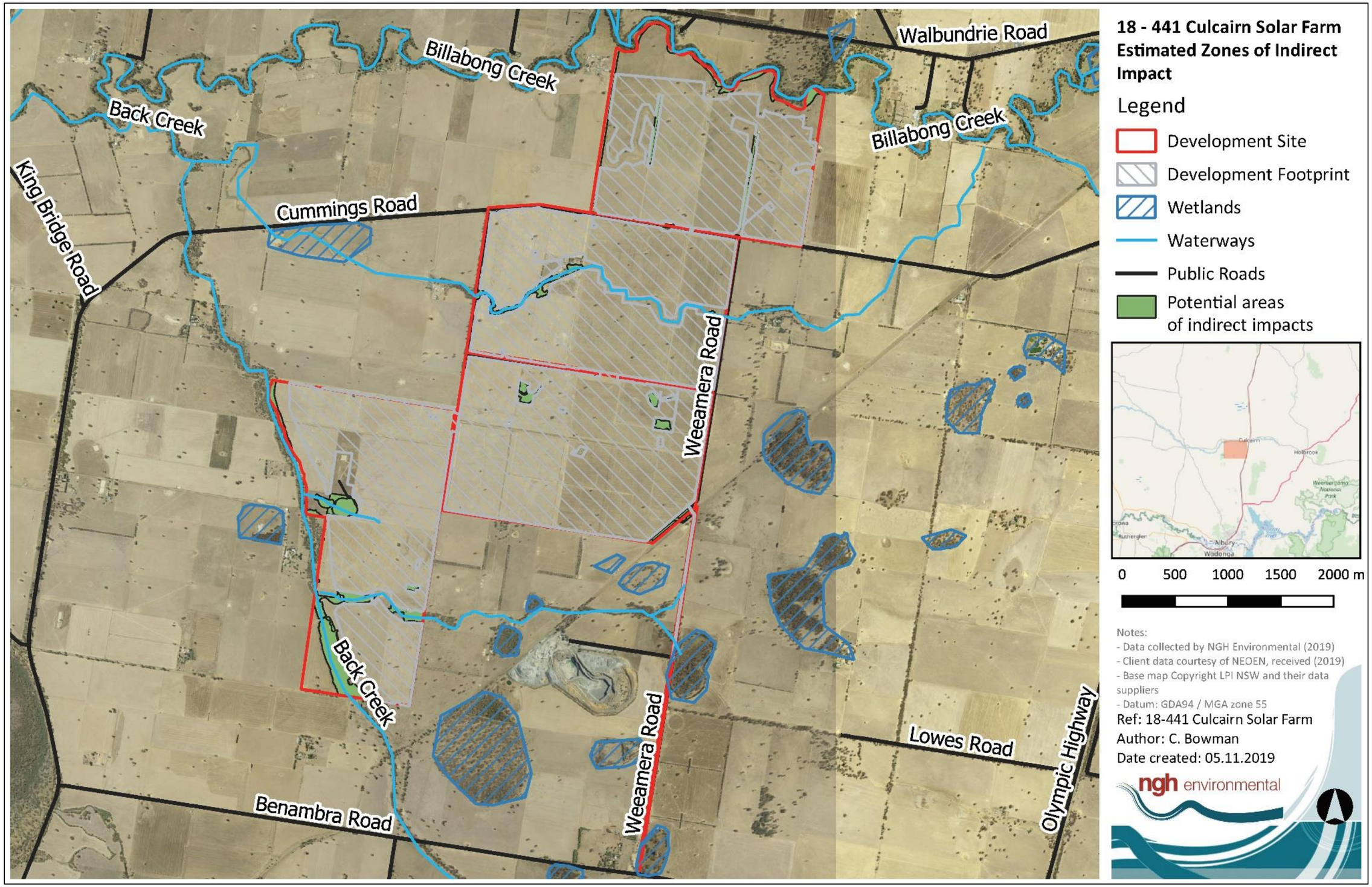

Figure 7-1 Estimated zones of indirect impact for the proposal

7.3 PRESCRIBED IMPACTS

The following prescribed biodiversity impacts are relevant to the proposal:

- Impacts of the development on the connectivity of different areas of habitat of threatened species that facilitates the movement of these species across their range;
- Impacts of the development on movement of threatened species that maintains their life cycle;
- Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation;
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities; and
- Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC.

These are discussed in detail below and the necessary information required by Section 9.2 of the BAM provided.

7.3.1 Impacts to karst, caves, crevices, cliffs and other features of geological significance

There are no karsts caves, crevices, cliffs or other features of geological significance in the development site or buffer area.

7.3.2 Impacts of development on the habitat of threatened species or ecological communities associated with rocks

There are no anticipated impacts on any rocks in the development site.

7.3.3 Impacts of development on the habitat of threatened species or ecological communities associated with human made structures

Twenty (20) human made dams fall within the development area. All dams were surveyed for potential threatened species including; Southern Bell Frog, and Sloane's Froglet, with both going undetected within the development area (Dams are not suitable habitat for the Booroolong Frog). All dams will be retained in the final development design. No other human made structures will be impacted within the development site.

7.3.4 Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation

Non-native groundcover species occupying much of the development site will be disturbed and shaded by solar infrastructure, but this is not anticipated to impact any threatened species.

7.3.5 Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

Retaining the vegetation along Back Creek in the development site will maintain connectivity across the landscape to facilitate movement in an east-west direction. This creek line also connects to the remnant roadside vegetation that would be retained. Due to the highly cleared and fragmented landscape within the development site the proposal is not likely to disrupt the movement of any threatened species.

7.3.6 Impacts of the development on movement of threatened species that maintains their life cycle

For migratory threatened species that may move across the landscape, retaining the revegetation along Back Creek will maintain connectivity across the landscape to facilitate movement in an east-west direction. This creek line also connects to the remnant roadside vegetation that would be retained. Due to the highly cleared and fragmented landscape within the development site the proposal is unlikely to disrupt the movement of any other threatened species that maintains their lifecycle.

7.3.7 Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development)

The construction of the proposal would involve a range of activities that would disturb soils and potentially lead to sediment laden runoff affecting local waterways during rainfall events. These potential impacts are unlikely to significantly impact water quality with the implementation of recommended mitigation measures including erosion and sedimentation controls. The use of fuels and other chemicals on site during construction poses a risk of surface water contamination in the event of a spill. Mitigation measures to implement spill management procedures would minimise impacts to waterways and hydrological processes.

7.3.8 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

The proposal would not directly increase impacts of vehicle strikes on threatened species. The development site is surrounded by country roads that threatened species such would currently be crossing. However, an increase in vehicle traffic may increase vehicle strikes on these threatened species outside of the study area. Site management to enforce and reduce site speed limits would minimise impacts of vehicle strikes within the subject land.

7.4 IMPACTS TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

7.4.1 Wetlands of international importance

The EPBC Protected Matters search identified one wetland of international importance; Walla Walla Swamp (Gum Swamp) located approximately 2.5km West of the development site.

The *Terrestrial Biodiversity Map of the Greater Hume LEP 2012* indicates that no wetlands of international importance occur within the development site and therefore none would be impacted by the development.

7.4.2 Threatened Ecological Communities

Three threatened ecological communities were returned from the EPBC Protected Matters report.

These include:

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion, Endangered under the BC Act
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions
- White Box Yellow Box Blakely's Red Gum Woodland; endangered under the BC Act and Critically Endangered under the EPBC Act

Four PCTs were identified within the development site that are associated with federally listed TECS:

- PCT 249: River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, associated with the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin
- PCT 277: Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, associated with White Box Yellow Box Blakely's Red Gum Woodland
- PCT 74: Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion, associated with White Box Yellow Box Blakely's Red Gum Woodland
- PCT 76: Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, associated with Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion

PCT 249 within the development site is not within an area featuring natural springs from the Great Artesian Basin and does not feature any endemic species restricted to such springs. As such, PCT 249 within the development site does not form part of the federally listed TEC.

PCTs 277 and 74 within the development site do not meet the condition thresholds for White Box Yellow Box Blakely's Red Gum Woodland. In particular, the patches do not have a predominately native understorey and there are less than 12 native understorey species present. As such, PCTs 277 and 74 do not form part of the federally listed TEC.

PCT 76 within the development site does not meet the condition thresholds for Western Grey Box tall grassy woodland on alluvial loam and clay soils. In particular, less than 50% of the vegetative cover in the ground layer comprises perennial native species at any time of the year and there are less than 8 perennial native species in the mid and ground layers. As such, PCT 76 does not form part of the federally listed TEC.

As no federally listed TECs are present within the development site, no AoS have been prepared.

7.4.3 Threatened Species

Based on a habitat assessment, nine (9) federally listed species could occur in the development site. These are:

- Superb Parrot (*Polytelis swainsonii*). - V
- Painted Honeyeater (*Grantiella picta*). – V
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – V
- White-throated Needletail (*Hirundapus caudacutus*) – V
- Swift Parrot (*Lathamus discolor*). - CE
- Regent Honeyeater (*Anthochaera phrygia*). – CE
- Sloane's Froglet (*Swainsona sericea*) - E
- Koala (*Phascolarctos cinereus*) -V
- Small Purple-pea *(Swainsona recta)* - E

Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail

These species are listed as vulnerable under the EPBC Act. Suitable Woodland habitat is present for the Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail in the development site. Surveys were undertaken for these species and they were not detected. However, it is considered these species may forage in the development site on occasion.

EPBC Assessments of Significance (AoS) was completed for these species (Appendix F) and concluded that a significant impact was unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

No referral is considered necessary to the Federal Department of Environment and Energy

Swift Parrot and Regent Honeyeater

These species are listed as critically endangered under the EPBC Act. Suitable woodland is present for the Swift Parrot and the Regent Honeyeater within the development site. Surveys were undertaken for these species and they were not detected. However, it is considered these species may forage in the development site on occasion.

EPBC Assessments of Significance (AoS) was completed for these species (Appendix F) and concluded that a significant impact was unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species

- Interfere with the recovery of these species.

No referral is considered necessary to the Federal Department of Environment and Energy

Sloane's Froglet

Suitable habitat for the Sloane's Froglet occurs in the farm dams throughout the development site. Surveys for Sloane's Froglet were undertaken at each of the dams in August 2019 using call playback. This species was not detected, and it is not considered to occur within the development site.

Small Purple-pea

No EPBC listed flora species were recorded during the surveys, however one EPBC-listed endangered species, the small purple pea was assumed present based on suitable habitat. Habitat for these species within the development site is primarily limited to areas with native understory, approximately 0.61 ha of the development footprint.

EPBC Assessments of Significance (AoS) was completed for the Small Purple Pea (Appendix F) and concluded that a significant impact was unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

No referral is considered necessary to the Federal Department of Environment and Energy.

7.4.4 Potential Koala habitat

Habitat for Koalas within the development site is isolated and highly degraded and it is considered unlikely that the Koala would utilise the habitats available.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist proponents in determining if a proposal may impact on habitat critical to the survival of the Koala. The tool is provided as Table 7-6 below as it applies to the proposal. Impact areas that score five or more using the habitat assessment tool contain habitat critical to the survival of the Koala. The assessment in Table 7-6 resulted in a score of 2, and so habitat within the study area is not considered to be critical to the survival of the Koala, and an assessment of significant impact according to the EPBC Act significant impact criteria is not required.

Table 7-6: Koala habitat assessment tool for inland areas (DoE 2014)

Attribute	Score	Inland	Applicable to the proposal?
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the	

Attribute	Score	Inland	Applicable to the proposal?
		last 10 years.	
	0 (low)	None of the above.	✓ No records of Koala within 10km of the development site. Koala not detected during site surveys.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	✓ Red River Gum, Blakely's Red Gum and Yellow Box are food tree species in the South Western Slopes Bioregion
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	
	0 (low)	None of the above.	
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	✓ Development site part of linear riparian corridor along Back Creek connecting to Billabong Creek
	0 (low)	None of the above.	
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	

Attribute	Score	Inland	Applicable to the proposal?
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	✓ No Koala mortality observed during the survey
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	✓ Study area is not considered a habitat refuge nor does it provide important connectivity to large areas surrounding a habitat refuge
Total	**3**	**Decision: Habitat not critical to the survival of the Koala—assessment of significance not required**	

1.1.1 Migratory Species

Based on a habitat assessment, the development site contains habitat that could be potentially used by two federally listed migratory species could occur in the development site. These are:

- Fork-tailed Swift (*Apus pacificus*)
- White-throated Needletail (*Hirundapus caudacutus*)

An Assessment of Significance was undertaken for these species (Appendix G) and determined that the project is unlikely to cause a significant impact to any criteria. The proposal is therefore considered unlikely to significantly impact the Fork-tailed Swift or the White-throated Needletail and no referral to the Federal Department of Environment is considered necessary.

7.5 LIMITATIONS TO DATA, ASSUMPTIONS AND PREDICTIONS

The floristic plots are based on a single visit survey. Floristic surveys were undertaken during the optimal flowering time for species in Spring and Summer, however it is possible that not all plant species were detected that may be present at the site due to seasonal and climatic constraints. In particular, inconspicuous or geophytic species which flower outside the surveyed period may not have been recorded.

The calculation of hollow-bearings trees, in particular the size and number of hollows, was made from ground level. It is possible that some hollows are present that were not visible from ground level, which may result in underestimates of the number of hollows. However, it was noted where it was considered likely that hollows were present but not visible from ground level

8 MITIGATING AND MANAGING IMPACTS

8.1 MITIGATION MEASURES

A general summary of the key measures required to mitigate the impacts of the proposal is provided below. Mitigation measures proposed to manage impacts, including proposed techniques, timing, frequency, responsibility for implementing each measure, risk of failure and an analysis of the consequences of any residual impacts are provided in Table 8-1.

8.1.1 Impacts from the clearing of vegetation and habitats

1. Time works to avoid critical life cycle events;
2. Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler; and
3. Relocate habitat features (fallen timber, hollow logs) from within the development site.

8.1.2 Indirect impacts

1. Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed;
2. Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise
3. Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light soil
4. Adaptive dust monitoring programs to control air quality;
5. Temporary fencing to protect significant environmental features such as riparian zones;
6. Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas; and
7. Staff training and site briefing to communicate environmental features to be protected and measures to be implemented.
8. Preparation of a vegetation management plan to regulate activity in regulation and habitat adjacent to the proposed development
9. Implement erosion and sediment controls

8.1.3 Prescribed impacts

1. Sediment barriers and spill management protocols to control the quality of water runoff from the site into the receiving environment;
2. Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation;
3. Staff Training and site briefing to communicate impacts of traffic strikes on native fauna

Table 8-1 Mitigation measures proposed to avoid and minimise impacts on native vegetation and habitat

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Displacement of resident fauna through vegetation clearing and habitat removal						
Time works to avoid critical life cycle events	• Hollow-bearing trees would not be removed during breeding season (spring to summer) to mitigate impacts on hollow dependent birds • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure no impacts to fauna would occur	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler	• Pre-clearing checklist • Tree clearing procedure	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted
Relocate habitat features (fallen timber, hollow logs) from within the development site	• Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement	Construction	Regular	Contractor	Low	None
Indirect impacts on native vegetation and habitat						
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is	• Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing • No stockpiling or storage within dripline of any mature trees	Construction	Regular	Contractor	Low	None

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
preferable in situations where partial clearing is proposed	• In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance; • Access to the Box-Gum Woodland EEC would not be permitted via vehicles to reduce understorey impacts and clearing; and • Strict weed protocol must be observed at all times.					
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	• Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	Construction	Regular	Contractor	Low	None
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	• Avoid night works; and • Direct lights away from vegetation.	Construction/ Operation	Regular	Contractor	Low	None
Adaptive dust monitoring programs to control air quality	• Daily monitoring of dust generated by construction activities; and • Construction would cease if dust observed being blown from site until control measures were implemented; and • All activities relating to the proposal would be undertaken with the objective of preventing	Construction	Regularly	Contractor	Moderate	Sedimentation in ephemeral waterways and dams.

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	visible dust emissions from the development site.					
Temporary fencing to protect significant environmental features such as riparian zones	• Prior to construction commencing, exclusion fencing, and signage would be installed around habitat to be retained	Construction	Regularly	Contractor	Low	None
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	• A Weed Management procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would include: ○ Management protocol for declared priority weeds under the *Biosecurity Act 2015* during and after construction; ○ Weed hygiene protocol in relation to plant, machinery, and fill; • Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported; and • The weed management procedure would be incorporated into the Biodiversity Management Plan.	Construction, Operation	Regular	Contractor	Moderate	Weed encroachment
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	• Site induction; and • Toolbox talks.	Construction	Regular	Contractor	Moderate	Impacts to native vegetation or threatened species for Staff training not being followed

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Preparation of a vegetation management plan to regulate activity in vegetation and habitat adjacent to the proposed development	• Preparation of a Biodiversity management plan that would include protocols for: ○ Protection of native vegetation to be retained; ○ Best practice removal and disposal of vegetation; ○ Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist; ○ Weed management; ○ Unexpected threatened species finds; ○ Exclusion of vehicles through sensitive areas; ○ Best practice clearing of overstorey vegetation for construction of the transmission line to avoid understorey impacts; and ○ Rehabilitation of disturbed areas.	Construction	One-off	Contractor	Moderate	Impacts to native vegetation or threatened species for Biodiversity Management Plan not being followed.
Implement Erosion and sediment controls	• An erosion and sediment control plan would be prepared in conjunction with the final design and implemented	Construction	Regular	Contractor	Moderate	Impacts may occur if erosion and sedimentation control plan not implemented
Prescribed biodiversity impacts						

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment	• An erosion and sediment control plan would be prepared in conjunction with the final design and implemented; and • Spill management procedures would be implemented.	Construction	Regular	Contractor	Moderate	Impacts may occur to waterway if erosion and sedimentation control plan not implemented
Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation	• Landscape plantings will be comprised of local indigenous species	Operation	Regular	Client	Moderate	Plants not surviving
Staff training and site briefing to communicate impacts of traffic strikes on native fauna	• Awareness training during site inductions regarding enforcing site speed limits; and • Site speed limits to be enforced to minimise fauna strike.	Construction and Operation	Regular	Contractor	Moderate	Fauna strikes from vehicles

8.2 ADAPTIVE MANAGEMENT STRATEGY

No adaptive management strategy is proposed for the development.

9 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

The principles used to determine if a development will have serious and irreversible impacts, include impacts that:

- Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to be in a rapid rate of decline;
- Will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very small population size;
- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very limited geographic distribution; or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

9.1 POTENTIAL SERIOUS AND IRREVERSIBLE IMPACT ENTITIES

9.1.1 Threatened ecological communities

One threatened ecological community will be impacted on by the proposal that is listed as a potential SAII entity in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*. This is the:

- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland

9.1.2 Threatened species

No threatened species will be impacted on by the proposal that is listed as a potential SAII entity in the *Guidance to assist a decision-maker to determine a serious and irreversible impact.*

No further species were considered to be potential SAII entities.

9.2 ASSESSMENT OF SERIOUS AND IRREVERSIBLE IMPACTS

9.2.1 White Box - Yellow Box – Blakely's Red Gum Woodland (Box-gum Woodland)

An assessment of the impacts to Box-gum Woodland was undertaken. Figure 9-1 shows the location of the Box-gum Woodland within the development site.

a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

The Box-Gum Woodland within the development site is comprised of (1.66 ha) moderately contiguous patches along the roadsides of Weeamera Road and Schoffs Lane. The mid story is minimal to non-existent, with the understory highly disturbed and subject to high weed incursion. The patches of woodland vegetation are unable to be avoided because the size constraints of the solar panels and trackers are unable to adapt around small patches of vegetation (Schoffs Lane), where Weeamera Road provides access to the Solar Farm.

b) the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

0.61 ha of Box-Gum Woodland would be impacted by the proposal. This vegetation is comprised mainly of mature Yellow Box and Blakely's Red gum with a disturbed understory due to heavy weed incursion on the roadsides of Weeamera Road and Schoffs Lane. A small area (0.01 ha) of TEC with native understory and derived native grassland (0.01 ha) will be impacted

Zone ID	Zone Description	Impact area	Composition score	Structure score	Function score	Vegetation Integrity Score
277_derived_grassland	277_derived_grassland	0.01	31.5	46.8	11.9	**26.1**
277_exotic_understory	277_exotic_understory	0.59	14.4	30.5	76.1	**32.3**
277_native_understory	277_native_understory	0.01	41.2	53.9	50.1	**48.1**

c) a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

No threshold has yet been defined by OEH for the extent of Box-gum Woodland to be removed that constitutes a serious and irreversible impact**.**

d) the extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint

Using GIS and State Vegetation Mapping (VIS_4468 & 4469), it is estimated that 88.8 ha of Box-gum Woodland occurs within an area of 1000 ha surrounding the proposed development footprint, and 570 ha of Box-gum Woodland occurs within an area of 10 000 ha surrounding the proposed development footprint (Figure 9-1).

e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

Using GIS and State Vegetation Mapping (VIS_4468 & 4469), it is estimated that 32 801ha of Box-gum Woodland occurs within the Lower Slopes IBRA Subregion. Vegetation mapped from aerial imagery is assumed to be in moderate to good condition. Up to 0.61 ha is proposed to be removed by the development, which is less than 0.001% of the estimated extent remaining.

f) an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion

In NSW, Box-gum Woodland is known to occur within at least 42 reserve systems. Around 8 000 ha of Box-gum Woodland is estimated to occur in national parks and nature reserves within the NSW South Western Slopes IBRA Region (Benson 2008). Using GIS Vegetation Mapping it is estimated that 481ha of Box-gum Woodland occurs in four reserves in the Lower Slopes Subregion.

g) the development, clearing or biodiversity certification proposal's impact on:

i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns

Groundwater supplies and levels are unlikely to be affected by the proposal and no groundwater is anticipated to be intercepted or extracted. During construction, the proposal would have a short-term gross impact upon soils and possibly surface water flow, within discreet areas. These impacts are manageable with the implementation of erosion and sediment controls and would be unlikely to impact on abiotic factors critical to the long-term survival of Box-gum Woodland.

ii. characteristic and functionally important species through impacts such as but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

The proposal would remove 0.61 ha of Box-gum Woodland which would permanently remove the characteristic overstory species of Yellow Box (*Eucalyptus melliodora*) and Blakley's Red Gum (*Eucalyptus blakelyi*) in these areas. These areas have minimal to no native midstorey and an understory that is highly disturbed due to high weed incursion.

iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts

Up to 0.61 ha of Box-gum Woodland would be removed reducing the vegetation quality and integrity of this patch to 0. No further impacts would occur to remaining Box-gum Woodland in the locality.

h) direct or indirect fragmentation and isolation of an important area of the potential TEC

There are small fragmented patches of Box-gum Woodland in the development site as well as patches that are semi contiguous to larger bushland areas. The small area being removed would not cause further fragmentation to areas of Box-gum Woodland in the locality.

i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

The proposal will require the retirement of ecosystem credits in accordance with the BAM, which will result in the establishment of Biodiversity Stewardship Sites, leading to the long-term security of the TEC within the subregion.

The proposal would remove 0.61 ha of Box-gum Woodland. Extensive areas of Box-gum Woodland occur within 1000 ha and 10 000 ha of the development site. Based on these factors, the removal of a very small area of low-quality vegetation is considered unlikely to have a serious and irreversible impact on the Box-gum Woodland EEC in the locality.

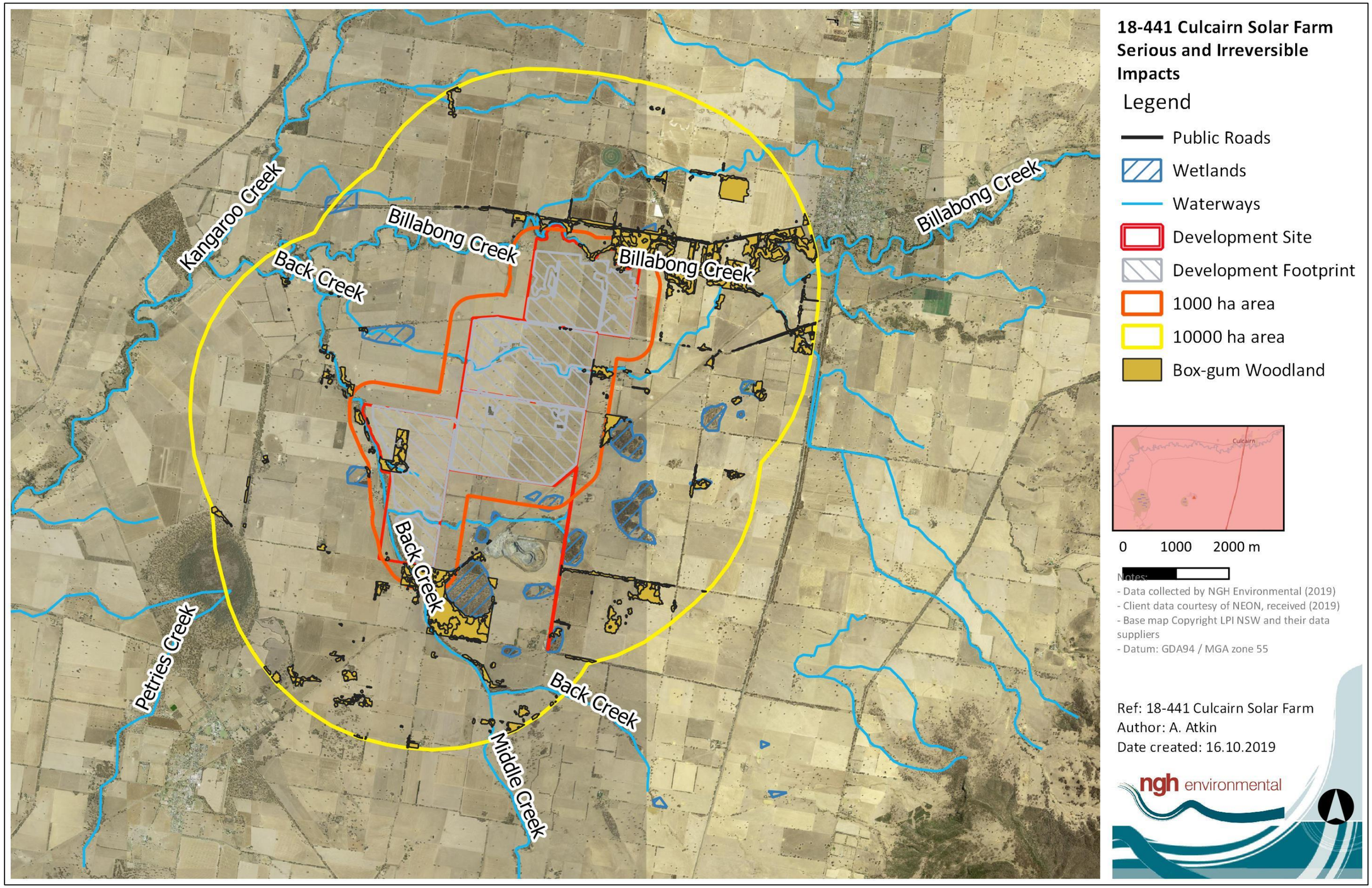

Figure 9-1 Location of serious and irreversible impacts

10 REQUIREMENT TO OFFSET

10.1 IMPACTS REQUIRING AN OFFSET

10.1.1 Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

a) a vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community, or
b) a vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or
c) a vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 10-1 and mapped on Figure 10-1. The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix D.

Table 10-1 PCTs and vegetation zones that require offsets.

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation Integrity Score	Vegetation integrity loss	Ecosystem credits required
277_derived_grassland	277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	0.01	26.1	26.1	1
277_exotic_understory	277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	0.59	32.3	32.3	10
277_native_understory	277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	0.01	48.1	48.1	1
					TOTAL:	**12**

10.1.2 Paddock tree credits

Offsets are required for the clearing of Class 2 and Class 3 paddock trees. 99 class 3 paddock trees occur within the development site. The paddock trees form part of PCT76: Western Grey Box tall grassy Woodland on alluvial loam and clay soils in the NSW South Western Slopes Bioregion and PCT277 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion. Ecosystem credits are calculated as per the streamlined assessment defined in Appendix 1 and Table 12 of the NSW BAM.

These ecosystem credits required are documented in Table 10-2. The credit profile for the paddock trees is shown in Appendix G.

92 ecosystem credits are required for the clearing of the paddock trees.

Table 10-2 Paddock trees that require offsets.

Class of Paddock Tree being cleared	PCT	Number of trees with Hollows	Number of Paddock Trees to be cleared	Ecosystem credits required
Class 2 (>20cm DBH and < 50cm DBH)	**277**	**0**	**0**	**0**
Class 2 (>20cm DBH and < 50cm DBH)	**76**	0	0	0
Class 3 >50cm DBH	**277**	58	79	74
Class 3 >50cm DBH	**76**	13	20	18
	TOTAL:	71	**99**	**92**

10.1.3 Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 10-3.

The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix G.

Table 10-3 Species credit species that require offsets.

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost (ha)	Species credits required
Small Scurf-pea *Cullen parvum*	2	0.61	10
Small Purple-pea *Swainsona recta*	2	0.61	10
Silky Swainson-pea *Swainsona sericea*	2	0.61	10

10.1.4 Offsets required under the EPBC Act

No species listed on the EPBC Act have been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets in accordance with the EPBC Offsets Policy.

10.2 IMPACTS NOT REQUIRING AN OFFSET

Impacts to PCTs that do not meet the thresholds identified in Section 10.1.1 do not require offsets. These PCTs and vegetation zones are mapped on Figure 10-1. 974 ha of exotic vegetation comprised of crops and pastoral grasses would be impacted by the proposal. No threatened species were observed dependent on this habitat. Exotic vegetation is not required to be offset and does not require further assessment. Paddock trees occurring within this vegetation have been offset through the generation of ecosystem credits.

10.3 AREAS NOT REQUIRING ASSESSMENT

Identification of areas not requiring assessment in accordance with BAM Section 10.4 i.e. land without native vegetation. These areas are mapped on Figure 10-1.

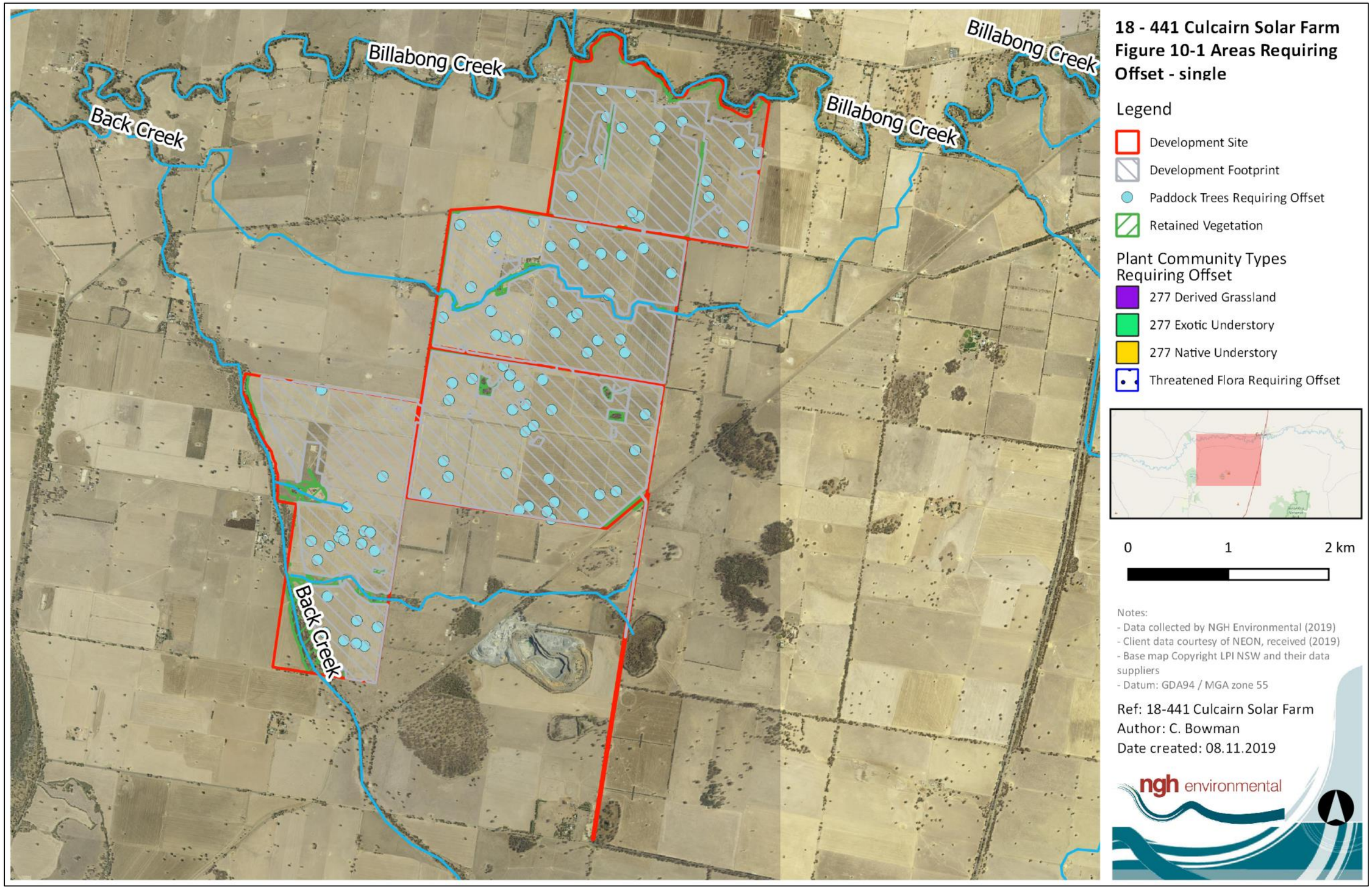

Figure 10-1 Impacts requiring offset, not requiring offset and not requiring assessment

10.4 SUMMARY OF OFFSET CREDITS REQUIRED

Table 10-4 Summary of offset credits required.

Ecosystem Credits	**Offset credits required**
277 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	12
277 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (Paddock Trees)	74
76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Paddock Trees)	18
TOTAL	**104**
Species Credits	Offset Credits required
Small Scurf-pea *Cullen parvum*	10
Small Purple-pea *Swainsona recta*	10
Silky Swainson-pea *Swainsona sericea*	10
TOTAL	**30**

11 CONCLUSIONS

NGH Consulting has prepared this BDAR on behalf of NEOEN for the Culcairn Solar Farm, 4.3 km northeast of Culcairn, NSW. The proposal would develop around 1126 ha hectares (ha) of the 1367 ha development site.

The aim of this BDAR is to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) and to address the requirements of the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act). This BDAR forms part of an Environmental Impact Statement (EIS) for the State Significant Development (SSD), prepared under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The BDAR includes:

- Comprehensive mapping and assessment completed in accordance with the BAM.
- Identification of four plant community types and one threatened species within the development site, the impacts to which have been adequately assessed.
- Mitigation measures which have been outlined to reduce the impacts to biodiversity
- The generation of 104 ecosystem credits within the development site, and 30 species credits.

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Scheme, and will be achieved by either:

a) Retiring credits under the Biodiversity Offsets Scheme based on the like-for-like rules, or
b) Making payments into the Biodiversity Conservation Fund using the offset payments calculator, or
c) Funding a biodiversity action that benefits the threaten entity(ies) impacted by the development.

12 REFERENCES

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APPENDIX A PLOT FIELD DATA

	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
TREES																							
	Eucalyptus albens	White Box	Myrtaceae									8	1										
	Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae													0.1	1						
	Eucalyptus camaldulensis	River Red Gum	Myrtaceae													8	1	15	10	30	5		
	Eucalyptus melliodora	Yellow Box	Myrtaceae					0.2	0														
	Eucalyptus microcarpa	Western Grey Box	Myrtaceae																			20	1
FORBS																							
*	*Acetosella vulgaris*	Sheep Sorrel	Polygonaceae									0.2	150	-	-								
*	*Cirsium vulgare*	Spear Thistle	Asteraceae							0.1	2					0.1	1						
*	*Citrullus lanatus*	Camel Melon	Cucurbitaceae			0.1	5	0.1	3	0.1	5	0.1	20	-	-	1	-						
*	*Cucumis myriocarpus*	Paddy Melon	Cucurbitaceae			1	500			0.5	-	0.5	1000	-	-	1	-						
	Dysphania pumilio	Black Crumbweed	Chenopodiaceae	0.1	80	5	500	0.2	500			0.3	250	0.1	20	0.2	50						
*	*Emilia sonchifolia*	Sow Thistle	Asteraceae															0.1	1				
*	*Erodium spp.*	Crowfoot	Geraniaceae			0.1	4	0.1	5			0.1	200										
	Eryngium ovinum	Blue Devil	Apiaceae															0.5	60				
	Euphorbia drummondii	Caustic weed	Euphorbiaceae					0.1	5														

	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	*Hypericum perforatum*	St John's Wort	Hypericaceae	0.1	2																		
*	*Hypochaeris radicata*	Catsear	Asteraceae							0.1	3	0.1	1			0.1	1	0.1	2				
*	*Lactuca saligna*	Willow-leaved Lettuce	Asteraceae			0.1	2																
*	*Lactuca serriola*	Prickly Lettuce	Asteraceae																			1	3
*	*Lepidium africanum*	Common Peppercress	Brassicaceae			0.5	50	0.1	20	0.1	25	0.2	100	X	X	0.1	4						
	Lobelia purpurascens	Whiteroot	Lobeliaceae																	0.1	20		
*	*Malva parviflora*	Small-flowered Mallow	Malvaceae	0.5	200	0.1	20	0.5	50			0.2	25			0.2	X						
	Medicago sativa	Lucerne	Fabaceae (Faboideae)	0.1	25																		
*	*Medicago spp.*	A Medic	Fabaceae (Faboideae)	0.1	2							0.1	8			2	1000						
*	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae							0.1	5	0.3	50			0.1	10						
	Oxalis perennans		Oxalidaceae							0.1	20												
	Persicaria decipiens	Slender Knotweed	Polygonaceae							5	X					0.5	20						
*	*Physalis hederifolia*	Sticky Cape Gooseberry	Solanaceae													X	X						
*	*Plantago lanceolata*	Lamb's Tongues	Plantaginaceae															0.1	1				

	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	*Polygonum aviculare*	Wireweed	Polygonaceae	0.5	50	0.1	1	0.1	2	30	X	0.5	100	X	X	0.2	X						
	Polygonum plebeium	Small Knotweed	Polygonaceae													0.1	5						
	Portulaca oleracea	Pigweed	Portulacaceae													0.1	340						
	Rumex brownii	Swamp Dock	Polygonaceae			0.1	2			0.1	1	0.1	1	0.1	10	0.1	2	0.1	1	0.1	6		
*	*Rumex crispus*	Curled Dock	Polygonaceae			0.1	1			0.1	20	0.1	20			0.1	2			0.1	4		
*	*Salvia verbenaca*	Wild Sage	Lamiaceae							0.1	20	0.1	5										
	Sida cunninghamii	Ridge Sida	Asteraceae															0.1	20				
*	*Solanum elaeagnifolium*	Silver-leaved Nightshade	Solanaceae																			0.2	30
*	*Sonchus oleraceus*	Sow Thistle	Asteraceae																	0.1	3		
*	*Trifolium spp.*	A Clover	Fabaceae (Faboideae)	0.1	50															0.1	1		
*	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Faboideae)							0.2	20	0.1	50	X	X								
*	*Vicia sativa*	Common vetch	Fabaceae (Faboideae)									0.01	10			0.1	5						
	Wahlenbergia spp.	Bluebell	Campanulaceae															0.1	1				
GRASS AND GRASS LIKE																							
*	*Avena fatua*	Wild Oats	Poaceae											0.5	X								
*	*Bromus diandrus*	Great Brome	Poaceae									0.1	10	35	1000							30	2000
*	*Bromus hordeaceus*	Soft Brome	Poaceae			5	500			5	X	35	1000	X	X	0.3	100						

	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	*Cenchrus clandestinus*	Kikuyu Grass	Poaceae													20	X						
	Chloris truncata	Windmill Grass	Poaceae									0.1	X										
	Cynodon dactylon	Common Couch	Poaceae			10	200	0.2	30			1	50	0.1	10	20	200	0.1	30				
*	*Cyperus eragrostis*	Umbrella Sedge	Cyperaceae													0.1	2						
*	*Hordeum leporinum*	Barley Grass	Poaceae	30	2000	50	3500	30	2000	30	X	25	1000	X	X	25	100					1	X
*	*Lolium perenne*	Perennial Ryegrass	Poaceae	0.5	50	5	300			5	X	0.3	1000	X	X	10	X	2	1000	70	5000	50	X
*	*Phalaris aquatica*	Phalaris	Poaceae	60	1000													0.1	1	2	15		
*	*Romulea rosea*	Onion grass	Iridaceae															0.5	5000				
	Rytidosperma spp.	Wallaby Grass	Poaceae															0.1	10			0.5	25
*	*Vulpia myuros*	Rat's Tail Fescue	Poaceae			5	500					0.5	100	X	X	0.1	10						
GRAMINOIDS																							
	Carex inversa	Knob Sedge	Cyperaceae															5	1000				
	Juncus spp.	A Rush	Juncaceae							10	150					0.1	4	0.1	100				

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
TREES																							
	Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae													4	2	30	250				
	Eucalyptus camaldulensis	River Red Gum	Myrtaceae							2	3												
	Eucalyptus melliodora	Yellow Box	Myrtaceae													4	1	15	150				
FORBS																							
*	*Acetosella vulgaris*	Sheep Sorrel	Polygonaceae									0.1	20									0.1	1
*	Brassica rapa ssp. campestris	Canola	Brassicaceae	40	5000																		
*	*Centaurium erythraea*	Common Centaury	Gentianaceae									0.1	2										
*	*Chondrilla juncea*	Skeleton Weed	Asteraceae																			0.1	2
*	*Cirsium vulgare*	Spear Thistle	Asteraceae					0.1	1			0.1	1					0.1	7				
*	*Conyza bonariensis*	Flaxleaf Fleabane	Asteraceae							0.1	7	0.1	20					0.1	1				
*	*Cucumis myriocarpus*	Paddy Melon	Cucurbitaceae			0.1	15																
	Desmodium varians	Slender Tick-trefoil	Fabaceae (Faboideae)																	1	100	0.1	2
	Dysphania pumilio	Black Crumbleweed	Chenopodiaceae																	0.1	1	0.1	1
*	*Echium plantagineum*	Patterson's Curse	Boraginaceae																			0.1	2
	Einadia nutans	Climbing Saltbush	Chenopodiaceae															6	50				

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	*Emilia sonchifolia*	Sow Thistle	Asteraceae																			0.1	5
*	*Erodium spp.*	Crowfoot	Geraniaceae			0.1	4	0.1	8											0.2	25	0.1	10
	Euphorbia drummondii	Caustic weed	Euphorbiaeceae			0.1	1	0.1	20											0.1	20		
	Galium aparine	Goosegrass	Rubiaceae																	0.1	10		
	Goodenia spp.		Goodeniaceae					0.1	20														
*	*Heliotropium europaeum*	Potato Weed	Boraginaceae																	0.1	3	0.5	50
	Hydrocotyle sibthorpioides		Apiaceae					2	1000														
	Hypericum gramineum	Small St John's Wort	Clusiaceae									0.1	0.1							0.1	0.3		
*	*Hypochaeris radicata*	Catsear	Asteraceae					0.1	15			0.1	30					0.1	1	0.2	30	0.21	10
*	*Lactuca saligna*	Willow-leaved Lettuce	Asteraceae					0.1	20	0.1	2							0.1	1				
*	*Lactuca serriola*	Prickly Lettuce	Asteraceae							0.1	1	0.1	1			0.1	4	0.1	3				
*	*Lepidium africanum*	Common Peppercress	Brassicaceae															0.1	15				
	Lobelia purpurascens	Whiteroot	Lobeliaceae					0.1	X														
	Lythrum hyssopifolia	Hyssop Loosestrife	Lythraceae									0.5	200									0.1	2
*	*Malva parviflora*	Small-flowered Mallow	Malvaceae			0.1	1																
*	*Marrubium vulgare*	White Horehound	Lamiaceae													0.5	38	0.1	1				

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	Medicago sativa	Lucerne	Fabaceae (Faboideae)			0.1	2																
*	*Modiola caroliniana*	Red-flowered Mallow	Malvaceae																	0.1	10		
	Oxalis perennans		Oxalidaceae			0.1	15	0.2	30														
	Persicaria decipiens	Slender Knotweed	Polygonaceae					0.1	5														
*	*Persicaria prostrata*	Creeping Knotweed	Polygonaceae							0.1	30	0.2	500										
*	*Plantago lanceolata*	Lamb's Tongues	Plantaginaceae																	0.5	100	0.5	30
*	*Polygonum aviculare*	Wireweed	Polygonaceae			X	X					0.2	50									0.1	1
	Portulaca oleracea	Pigweed	Portulacaceae			0.1	2																
	Pseudognaphalium luteoalbum	Jersey Cudweed	Asteraceae									0.2	100	0.1	6								
*	*Raphanus raphanistrum*	Wild Radish	Brassicaceae																	0.1	1		
	Rumex brownii	Swamp Dock	Polygonaceae			0.1	2													0.1	100		
*	*Rumex conglomeratus*	Clustered Dock	Polygonaceae					0.2	20														
*	*Rumex crispus*	Curled Dock	Polygonaceae			0.1	1											0.1	1				
*	*Salvia verbenaca*	Wild Sage	Lamiaceae																	0.1	5	0.1	5
	Sida cunninghamii	Ridge Sida	Asteraceae					0.1	40														
*	*Solanum elaeagnifolium*	Silver-leaved Nightshade	Solanaceae											0.1	15	0.1	5	0.1	2	0.5	30	5	50

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	*Solanum spp.*		Solanaceae													0.1	4						
*	*Sonchus oleraceus*	Sow Thistle	Asteraceae					0.1	10			0.1	30							0.1	2		
*	*Trifolium spp.*	A Clover	Fabaceae (Faboideae)																	0.1	0.1		
*	*Trifolium subterraneum*	Subterranean Clover	Fabaceae (Faboideae)			0.1	15																
*	*Verbascum virgatum*	Twiggy Mullein	Scrophulariaceae																			0.1	1
	Wahlenbergia spp.	Bluebell	Campanulaceae					0.1	500														
GRASS AND GRASS LIKE																							
	Anthosachne scabra	Native wheat	Poaceae																	0.1	1		
	Austrostipa aristiglumis	Plains Grass	Poaceae									1	15										
*	*Avena fatua*	Wild Oats	Poaceae																	0.5	10	5	504
*	*Bromus diandrus*	Great Brome	Poaceae							0.2	X	0.1	2			25	1000	40	1000	0.2	50	0.4	4
*	*Bromus hordeaceus*	Soft Brome	Poaceae			0.3	100			0.1	5	0.1	2									10	60
	Chloris truncata	Windmill Grass	Poaceae									0.1	3							10	200	0.1	2
	Cynodon dactylon	Common Couch	Poaceae					2	500	0.1	1					0.1	6	0.1	10	10	1000	0.1	3
*	*Cyperus eragrostis*	Umbrella Sedge	Cyperaceae									0.1	2					1	1				
*	*Eleusine tristachya*	Goose Grass	Poaceae																			0.1	2

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	*Hordeum leporinum*	Barley Grass	Poaceae	0.5	X	0.2	X																
*	*Lolium perenne*	Perennial Ryegrass	Poaceae	0.1	X	1	1000	80	5000			30	1000			50	1000	40	1000				
*	*Panicum capillare*	Witchgrass	Poaceae									25	1000	20	2000					30	2000	10	1000
*	*Paspalum dilatatum*	Paspalum	Poaceae																	8	80	0.1	1
*	*Phalaris aquatica*	Phalaris	Poaceae			70	X	3	40									0.1	1				
	Rytidosperma spp.	Wallaby Grass	Poaceae					0.1	20			0.1	7										
	Sporobolus caroli	Fairy Grass	Poaceae							10	25	10	1000										
*	*Vulpia myuros*	Rat's Tail Fescue	Poaceae			0.5	100	X	X			10	1000							30	5000	40	5000
GRAMINOIDS																							
	Carex inversa	Knob Sedge	Cyperaceae									5	100			0.1	1						
	Juncus ingens	Giant Rush	Juncaceae							0.1	1												
	Juncus spp.	A Rush	Juncaceae					0.1	20														
	Juncus subsecundus	Finger Rush	Juncaceae							95	5000	30	1000										

	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M	
				C	A	C	A	C	A	C	A	C	A	C	A
	Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae			10	6								
	Eucalyptus camaldulensis	River Red Gum	Myrtaceae	45	27										
	Eucalyptus melliodora	Yellow Box	Myrtaceae			5	2	30	3						
	Eucalyptus microcarpa	Western Grey Box	Myrtaceae							30	4				
*	*Schinus molle*	Peppercorn	Anacardiaceae	0.5	1										
FORBS															
*	*Carthamus lanatus*	Saffron Thistle	Asteraceae							0.1	0.1				
*	*Cirsium vulgare*	Spear Thistle	Asteraceae									0.1	1		
*	*Conyza bonariensis*	Flaxleaf Fleabane	Asteraceae									0.1	1	0.5	200
	Desmodium varians	Slender Tick-trefoil	Fabaceae (Faboideae)	0.5	50										
*	*Epilobium spp.*		Onagraceae											0.7	50
*	*Erodium spp.*	Crowfoot	Geraniaceae									0.1	15	0.1	10
	Euchiton spp.	A Cudweed	Asteraceae											0.1	1
	Euphorbia drummondii	Caustic weed	Euphorbiaceae									0.1	10	0.1	6
	Goodenia macbarronii	Narrow Goodenia	Goodeniaceae									0.1	5		
*	*Hypochaeris radicata*	Catsear	Asteraceae	0.1	3							0.5	500	0.2	50
*	*Lactuca serriola*	Prickly Lettuce	Asteraceae	0.1	2									0.1	1

	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M	
				C	A	C	A	C	A	C	A	C	A	C	A
*	*Lepidium africanum*	Common Peppercress	Brassicaceae	0.1	2			0.1	2	0.1	1				
*	*Lysimachia arvensis*	Scarlet Pimpernel	Myrsinaceae											0.2	10
	Lythrum hyssopifolia	Hyssop Loosestrife	Lythraceae									0.1	6	0.1	50
*	*Malva parviflora*	Small-flowered Mallow	Malvaceae	0.1	1										
	Oxalis perennans		Oxalidaceae											0.1	30
	Persicaria decipiens	Slender Knotweed	Polygonaceae	0.1	1										
*	*Plantago lanceolata*	Lamb's Tongues	Plantaginaceae					0.1	1	0.1	0.1			10	500
*	*Polygonum aviculare*	Wireweed	Polygonaceae	0.2	80										
	Pseudognaphalium luteoalbum	Jersey Cudweed	Asteraceae									0.1	5	0.1	1
	Rumex brownii	Swamp Dock	Polygonaceae	0.1	3			0.1	1						
*	*Rumex crispus*	Curled Dock	Polygonaceae	0.1	1					0.1	3			0.5	60
*	*Solanum elaeagnifolium*	Silver-leaved Nightshade	Solanaceae	0.4	80	25	300	25	300			0.1	18	0.1	4
*	*Solanum spp.*		Solanaceae									0.1	11		
*	*Sonchus oleraceus*	Sow Thistle	Asteraceae	0.1	20					0.1	5	0.1	50	0.1	2
*	Trifolium arvense	Haresfoot Clover	Fabaceae (Faboideae)									0.1	20		
*	*Trifolium spp.*	A Clover	Fabaceae (Faboideae)											0.5	100

	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M	
				C	A	C	A	C	A	C	A	C	A	C	A
GRASS AND GRASS LIKE															
	Anthosachne scabra	Native wheat	Poaceae					0.1	8			0.1	5		
	Austrostipa blackii		Poaceae									0.1	8		
	Austrostipa scabra	Speargrass	Poaceae									1	20		
*	*Avena fatua*	Wild Oats	Poaceae	0.2	100					0.1	2	2	700	0.1	20
	Bothriochloa macra	Red Grass	Poaceae									1	100		
*	*Briza minor*	Shivery Grass	Poaceae											0.1	3
*	*Bromus catharticus*	Praire Grass	Poaceae	0.1	1										
*	*Bromus diandrus*	Great Brome	Poaceae	60	5000	50	5000	60	X	2	100	0.1	1		
*	*Bromus hordeaceus*	Soft Brome	Poaceae							0.1	5	0.1	20	0.1	1
	Chloris truncata	Windmill Grass	Poaceae	0.1	10					0.1	2	15	800		
	Cynodon dactylon	Common Couch	Poaceae	0.2	30			0.1	4	1	80	10	1000	10	200
	Eragrostis spp.	A Lovegrass	Poaceae									0.1	5		
*	*Lolium perenne*	Perennial Ryegrass	Poaceae			30	X	20	X			0.5	1000	0.5	600
*	*Panicum capillare*	Witchgrass	Poaceae					0.1	20	0.1	30	20	1000	10	500
*	*Paspalum dilatatum*	Paspalum	Poaceae	5	30					20	30	40	150	50	500
*	*Phalaris aquatica*	Phalaris	Poaceae	1	5					1	7				

	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M	
				C	A	C	A	C	A	C	A	C	A	C	A
*	*Romulea rosea*	Onion Grass	Iridaceae	0.1	1									0.1	2
	Rytidosperma spp.	Wallaby Grass	Poaceae	0.1	3					0.1	1				
*	*Vulpia myuros*	Rat's Tail Fescue	Poaceae									10	1000	0.1	5
GRAMINOIDS															
	Carex inversa	Knob Sedge	Cyperaceae							0.1	2			0.1	9
	Juncus spp.	A Rush	Juncaceae	0.1	20			0.1	1						
	Juncus subsecundus	Finger Rush	Juncaceae	0.1	1					0.1	15				
	Lomandra filiformis	Wattle Matt-rush	Lomandraceae	0.1	20							0.5	1000		

APPENDIX B PADDOCK TREES

Species	DBH (cm)	Hollows Present	PCT	Paddock Tree Class	Ecosystem Credits
Grey Box	120	Yes	76	3	1
Grey Box	90	Yes	76	3	1
Grey Box	115	Yes	76	3	1
Grey Box	120	Yes	76	3	1
Grey Box	100	Yes	76	3	1
River Red Gum	150	Yes	277	3	1
Yellow Box	150	Yes	277	3	1
Grey Box	150	Yes	277	3	1
Grey Box	90	Yes	277	3	1
Grey Box	100	Yes	277	3	1
Yellow Box	100	Yes	277	3	1
Grey Box	100	Yes	76	3	1
Grey Box	110	Yes	76	3	1
Grey Box	90	Yes	76	3	1
Grey Box	0	Yes	76	3	1
Grey Box	130	Yes	277	3	1
Grey Box	200	Yes	277	3	1
Grey Box	110	Yes	277	3	1
Grey Box	70	Yes	277	3	1
Grey Box	120	Yes	277	3	1
Grey Box	75	Yes	277	3	1
Grey Box	100	Yes	277	3	1
Grey Box	200	Yes	277	3	1
Grey Box	95	Yes	277	3	1
Yellow Box	100	Yes	277	3	1
Grey Box	70	Yes	277	3	1
Grey Box	200	Yes	277	3	1
Grey Box	110	Yes	277	3	1
Grey Box	210	Yes	277	3	1

Species	DBH (cm)	Hollows Present	PCT	Paddock Tree Class	Ecosystem Credits
Yellow Box	70	Yes	277	3	1
Grey Box	180	Yes	277	3	1
Grey Box	150	Yes	277	3	1
White Box	89	Yes	277	3	1
Grey Box	80	Yes	277	3	1
Grey Box	120	Yes	277	3	1
Grey Box	100	Yes	277	3	1
Blakely's Red Gum	150	Yes	277	3	1
Grey Box	80	Yes	277	3	1
Grey Box	120	Yes	277	3	1
Grey Box	98	Yes	277	3	1
Grey Box	200	Yes	277	3	1
White Box	200	Yes	277	3	1
Grey Box	150	Yes	277	3	1
Blakely's Red Gum	110	Yes	277	3	1
Grey Box	110	Yes	277	3	1
Grey Box	120	Yes	277	3	1
Grey Box	150	Yes	277	3	1
Blakely's Red Gum	80	Yes	277	3	1
Blakely's Red Gum	90	Yes	277	3	1
Blakely's Red Gum	300	Yes	277	3	1
Grey Box	160	Yes	277	3	1
Grey Box	130	Yes	277	3	1
Grey Box	180	Yes	277	3	1
Grey Box	110	Yes	76	3	1
Grey Box	100	Yes	76	3	1
Grey Box	90	Yes	76	3	1
Grey Box	100	Yes	76	3	1

Species	DBH (cm)	Hollows Present	PCT	Paddock Tree Class	Ecosystem Credits
Blakely's Red Gum	-	Yes	277	3	1
Blakely's Red Gum	-	Yes	277	3	1
Blakely's Red Gum	-	Yes	277	3	1
Yellow Box	-	Yes	277	3	1
Yellow Box	-	Yes	277	3	1
Yellow Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Grey Box	-	Yes	277	3	1
Blakely's Red Gum	-	Yes	277	3	1
Grey Box	0	No	277	3	0.75
Grey Box	0	No	277	3	0.75
Grey Box	90	No	76	3	0.75
Grey Box	0	No	76	3	0.75
Grey Box	80	No	76	3	0.75
Yellow Box	70	No	277	3	0.75
Yellow Box	150	No	277	3	0.75
Grey Box	110	No	277	3	0.75
Grey Box	90	No	76	3	0.75
Grey Box	0	No	76	3	0.75
White Box	80	No	277	3	0.75
Grey Box	80	No	76	3	0.75

Species	DBH (cm)	Hollows Present	PCT	Paddock Tree Class	Ecosystem Credits
Grey Box	140	No	76	3	0.75
Grey Box	0	No	277	3	0.75
Grey Box	70	No	277	3	0.75
Grey Box	150	No	277	3	0.75
Grey Box	95	No	277	3	0.75
Yellow Box	75	No	277	3	0.75
Grey Box	300	No	277	3	0.75
Grey Box	98	No	277	3	0.75
Yellow Box	200	No	277	3	0.75
Yellow Box	85	No	277	3	0.75
Grey Box	100	No	277	3	0.75
Grey Box	0	No	277	3	0.75
Grey Box	0	No	277	3	0.75

APPENDIX C FAUNA SPECIES

Common Name	Scientific Name	Habitat	Coordinates
Australian Pelican	*Pelicanus conspicillatus*	Farm dam	
Little Pied Cormorant (in vicinity)	*Microcarbo melanoleucos*	Farm dam	
Red-capped Plover	*Charadrius ruficapillus*	Mudflats around farm dam	E 494973 N 6048587 GDA94 Z55
Black-fronted Dotterel	*Elseyornis melanops*	Mudflats around farm dam	E 494973 N 6048587 GDA94 Z55
Spur-winged Plover	*Vanellus miles*	Mudflats around farm dam	
Australian Wood Duck	*Chenonetta jubata*	Farm dams	
Grey Teal	*Anas gracilis*	Farm dams	
Pacific Black Duck	*Anas superciliosa*	Farm dams	
White-faced Heron	*Egretta novaehollandiae*	Drainage channel	
Yellow-billed Spoonbill (in vicinity)	*Platalea flavipes*	Farm dam	
Straw-necked Ibis	*Threskiornis spinicollis*	Farmland	
Wedge-tailed Eagle	*Aquila audax*	At height over farmland	E498738 N6051889 GDA94 Z55
Nankeen Kestrel	*Falco cenchroides*	At height over farmland	
Tawny Frogmouth	*Podargus strigoides*	Remnant roadside woodland	
Galah	*Eolophus roseicapilla*	Farmland and woodland	
Sulphur-crested Cockatoo	*Cacatua galerita*	Farmland	
Eastern Rosella	*Platycercus eximius*	Farmland and woodland	
Red-rumped Parrot	*Psephotus haematonotus*	Farmland	
Crested Pigeon	*Ocyphaps lophotes*	Remnant roadside woodland	
Laughing Kookaburra	*Dacelo novaeguineae*	Remnant riparian woodland	
Welcome Swallow	*Hirundo neoxena*	Farm sheds	
Martin sp.	*Petrochelidon sp.*	Remnant riparian woodland	

Common Name	Scientific Name	Habitat	Coordinates
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	Farmland	
Superb Blue Wren	*Malurus cyaneus*	Farmland and woodland	
White-plumed Honeyeater	*Ptilotula penicillata*	Farmland and woodland	
Noisy Miner	*Manorina melanocephala*	Remnant roadside woodland	
White-throated Treecreeper	*Cormobates leucophaea*	Remnant riparian woodland	
Brown Treecreeper	*Climacteris picumnus*	Remnant riparian and roadside woodland	E498198 N6046934 GDA94 Z55 1 heard E494770 N6047911 GDA94 Z55 1 heard
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Remnant riparian woodland	
Pied Currawong	*Strepera graculina*	Farmland	
Pied Butcherbird	*Cracticus nigrogularis*	Farmland	
Australian Magpie	*Cracticus tibicen*	Farmland	
White-winged Chough	*Corcorax melanorhamphos*	Remnant roadside woodland	
Australian Raven	*Corvus coronoides*	Farmland	
Little Raven	*Corvus mellori*	Farmland	
Peewee	*Grallina cyanoleuca*	Farmland	
Restless Flycatcher	*Myiagra inquieta*	Remnant riparian woodland	E494952 N6046934 GDA94 Z55
Willie Wagtail	*Rhipidura leucophrys*	Farmland	
Flame Robin	*Petroica phoenicea*	Farmland	E495913 N6047771 GDA94 Z55 2 M 1 F E498363 N 6048147 GDA94 Z55 1 M 1 F E498967 N6051586 GDA94 Z55

Common Name	Scientific Name	Habitat	Coordinates
Grey Shrike-thrush	*Colluricincla harmonica*	Remnant riparian woodland	
Brown Songlark	*Cincloramphus cruralis*	Farmland	
Australian Pipit	*Anthus australis*	Farmland	
***Common Starling**	*Sturnus vulgaris*	Farmland	
Common Brushtail Possum	*Trichosurus vulpecula*	Remnant riparian woodland	
Common Ringtail Possum	*Pseudocheirus peregrinus*	Remnant riparian woodland	
Eastern Grey Kangaroo	*Macropus giganteus*	Farmland	
***Red Fox**	*Vulpes vulpes*	Farmland	
White-striped Mastiff-bat	*Austronomus australis*	Farmland	
Eastern Sign-bearing Froglet	*Crinia parinsignifera*	Farm dams	

APPENDIX D PROTECTED MATTERS SEARCH RESULTS

APPENDIX E EPBC SPECIES HABITAT ASSESSMENT

The tables in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations listed from the EPBC Act Protected Matters Report.

The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

Presence of habitat:

Present: Potential or known habitat is present within the study area

Absent: No potential or known habitat is present within the study area

Likelihood of occurrence

Unlikely: Species known or predicted within the locality but unlikely to occur in the study area

Possible: Species could occur in the study area

Present: Species was recorded during the field investigations

Possible to be impacted

No: The proposal would not impact this species or its habitats. No further assessment would be necessary at this stage of the project.

Yes: The proposal could impact this species or its habitats. Further investigation into the likelihood and consequence of the impact of the proposal on these species would be considered under the EPBC Act for the EIS.

F.1 FLORA SPECIES

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
Flora				
Ammobium craspediodes Yass Daisy EPBC- V BC-	Found in moist or dry forest communities, Box-Gum Woodland and secondary grassland derived from clearing of these communities. Grows in association with a large range of eucalypts *Eucalyptus blakelyi*, *E. bridgesiana*, *E. dives*, *E. goniocalyx*, *E. macrorhyncha*, *E. mannifera*, *E. melliodora*, *E. polyanthemos*, *E. rubida.* Found from near Crookwell on the Southern Tablelands to near Wagga Wagga on the South Western Slopes. Most populations are in the Yass region.	**Present** Box-Gum Woodland and derived grasslands occur within the development site	**Unlikely** Understory highly degraded from intense grazing and cropping. Species was not identified during vegetation surveys.	**No** No suitable habitat would be impacted by the proposal
Amphibromus fluitans River Swamp Wallaby Grass EPBC – V BC - V IBRA Sub-region: Inland Slopes, Lower Slopes	*Amphibromus fluitans* grows mostly in permanent swamps. The species needs wetlands which are at least moderately fertile and which have some bare ground, conditions which are produced by seasonally-fluctuating water levels. Habitats in south-western NSW include swamp margins in mud, dam and tank beds in hard clay and in semi-dry mud of lagoons with *Potamogeton* and *Chamaeraphis* species. Flowering time is from spring to autumn or November to March. Disturbance regimes are not known, although the species requires periodic flooding of its habitat to maintain wet conditions. Wetlands inhabited by this species that are converted to deep, permanent dams are unsuitable for continued habitation by this species. The species has shown a level of resistance to salinization of habitat in experimental tests. Has been observed covering several hectares	**Absent** No permanent swamps or waterbodies with vegetation in study area.	**Unlikely** Species was not detected during vegetation surveys	**No** No suitable habitat would be impacted by the proposal.

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
	in area. The species is also recorded as occasional to common in populations.			
Brachyscome muelleroides Mueller Daisy EPBC - V	The species occurs in seasonally wet depressions in the landscape and appears to rely on seasonal inundation to survive.	**Absent** No permanent swamps or waterbodies with vegetation in study area.	**Unlikely** Species was not detected during vegetation surveys	**No** No suitable habitat would be impacted by the proposal.
Caladenia arenaria Sand-hill Spider Orchid EPBC – E BC – E IBRA Sub-region: Inland Slopes, Lower Slopes	Found mostly on the south west plains and western south west slopes. The Sand-hill Spider Orchid is currently only known to occur in the Riverina between Urana and Narranderra. Occurs in woodland with sandy soil, especially that's dominated by White Cypress Pine (Callitris glaucophylla). Many of the associated species in the understorey are different at each of the populations, or are species that are widespread and occur in a range of habitats. It is apparent that C. arenaria has fairly broad habitat tolerances, occurring in Callitris glaucophylla - Eucalyptus melliodora (Yellow Box) woodlands, Callitris glaucophylla – Allocasuarina luehmannii woodlands and woodlands dominated by a mixture of Callitris glaucophylla, E. dwyeri (Dwyer's Redgum) and Acacia doratoxylon (Currawang). Soils vary from skeletal soils over sandstone to clay loams.	**Absent** No sandy soils or White Cypress Pine within development site	**Unlikely** Understory highly degraded from intense grazing and cropping. Associated white Cypress absent from development site.	**No** No suitable habitat would be impacted by the proposal.
Swainsona recta Small Purple-pea	Occurs in grassland and open woodland, often on stony hillsides, dominated by one or more of the following: Callitris endichleri, C. glaucophylla, Eucalyptus blakelyi, E. bridgesiana, E. dives, E. melliodora, E. microcarpa, E. nortonii and E. polyanthemos. Requires a forb-rich grassy	**Present** Woodland present but understory	**Possible** Species assumed present in areas	**Yes** AoS Required

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
EPBC – E BC – E IBRA Sub-region: Inland Slopes, Lower Slopes	groundlayer dominated by Themeda triandra, Poa sieberiana var. sieberiana or Austrostipa spp. Resprouts in autumn and winter from a woody root. It flowers in spring, peaking over two to three weeks in October.	heavily grazed and degraded in most areas.	where native understorey is present.	
Prasophyllum petilum Tarengo Leek Orchid EPBC – E BC – E IBRA Sub-region: Inland Slopes	The flower-spike emerges in mid spring to early summer from a hole near the base of the leaf. Natural populations are known from a total of four sites in NSW: Boorowa, Captains Flat, Ilford and Delegate. Also occurs at Hall in the Australian Capital Territory. Grows in patchy woodland in fertile soils. Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock *Poa labillardieri* Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. at Captains Flat and within the grassy groundlayer dominated by Kangaroo Grass under Box-Gum Woodland at Ilford (and Hall, ACT). Apparently highly susceptible to grazing, being retained only at little-grazed travelling stock reserves (Boorowa & Delegate) and in cemeteries (Captains Flat, Ilford and Hall). Co-occurring species include *Pentapogon quadrifidus, Schoenus apogon, Drosera peltata, Sebaea ovata* and *Haloragis heterophylla.*	**Present** Woodland present but understory heavily grazed and degraded in most areas	**Unlikely** Species was not detected during vegetation surveys	**No** No suitable habitat would be impacted by the proposal.
Prasophyllum validum Sturdy Leek-orchid EPBC – V	The Sturdy Leek-orchid tends to grow in drier woodland habitats, generally with a low sparse understorey. In Victoria, it occurs in box and box-ironbark woodland with overstorey trees including Eucalyptus polyanthemos, Eucalyptus albens, Eucalyptus macrorhyncha, Eucalyptus viminalis and Callitris glaucophylla, and an open grassy to sparsely shrubby understorey including Themeda triandra, Joycea pallida, Arthropodium	**Absent** Species absent from species candidate list generated from Biodiversity Assessment	**Unlikely** Species was not detected during vegetation surveys	**No** No suitable habitat would be impacted by the proposal.

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
IBRA Sub-region: Inland Slopes	strictum, Acacia verniciflua, Bursaria spinosa, Grevillea alpine and Grevillea dryophylla. Soils vary from heavy clays to sandy loams.	Methodology Calculator		
EEC				
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland BC – E EPBC – CE IBRA Sub-region: Inland Slopes, Lower Slopes	Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles.	**Present** Characteristic tree species present in development site	**Likely** Development site within known distribution	**Yes** Assessment against EPBC Vegetation threshold required
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EPBC- E IBRA Sub-region: Inland Slopes	Generally occurs in landscapes of low-relief such as flat to undulating plains, low slopes and rises and, to a lesser extent, drainage depressions and flats. The tree canopy is dominated (≥ 50% canopy crown cover) by *Eucalyptus microcarpa* (Grey Box). Widespread associated tree species that may be present include: *Allocasuarina luehmannii* (Buloke), *Brachychiton populneus* (Kurrajong), *Callitris glaucophylla* (White Cypress Pine), *Eucalyptus albens* (White Box), *E. camaldulensis* (River Red Gum), *E. conica* (Fuzzy Box), *E. leucoxylon* (Yellow Gum, SA Blue Gum), *E. melliodora* (Yellow Box) and *E. populnea* (Bimble Box, Poplar Box). The ground layer also is highly variable in development and composition, ranging from almost absent to mostly grassy to forb-rich. Derived grasslands are a special state of the ecological community, whereby the canopy and mid	**Present** Characteristic tree species present in development site	**Likely** Development site within known distribution	**Yes** Assessment against EPBC Vegetation threshold required

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
	layers have been mostly removed to <10% crown cover but the native ground layer remains largely intact, with 50% or more of the total vegetation cover being native.			
Weeping Myall Woodlands EPBC – E	The Weeping Myall Woodlands occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland, with one small outlying patch in northern Victoria.. Occurs in a range from open woodlands to woodlands, generally 4-12 m high, in which Weeping Myall (Acacia pendula) trees are the sole or dominant overstorey species Weeping Myall trees often occur in monotypic stands, however other vegetation may also occur in the ecological community, though not as dominant species. These include: Western Rosewood (Alectryon oleifolius subsp. elongatus); Poplar Box (Eucalyptus populnea); or Black Box (Eucalyptus largiflorens). Grey Mistletoe (Amyema quandang) commonly occurs on the branches of Weeping Myall trees throughout the ecological community's range.	**Absent** No Weeping Myall (*Acacia pendula*) in study area.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.

F.1 FAUNA SPECIES

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Fauna				
Aves				
Anthochaera phrygia Regent Honeyeater BC - CE EPBC – CE IBRA Sub-region: Inland Slopes, Lower Slopes	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (NPWS, 1999 177 /id)(Pizzey, 1997). A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (NPWS, 1999 177 /id)(Pizzey, 1997).	**Present** River Red Gum Forests and Box-Gum Woodland present in development site	**Unlikely** Species was not detected during fauna surveys	**Yes** AoS required
Botaurus poiciloptilus Australasian Bittern EPBC – E BC - E IBRA Sub-region: Inland Slopes, Lower Slopes	In NSW, this species occurs along the coast and is frequently recorded in the Murray-Darling Basin, notably in floodplain wetlands of the Murrumbidgee, Lachlan, Macquarie and Gwydir Rivers. Occurs in permanent freshwater wetlands with tall, dense vegetation. Favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, , Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate. Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.	**Absent** No permanent wetlands in study area.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Calidris ferruginea Curlew Sandpiper EPBC – CE BC - E IBRA Sub-region: Inland Slopes, Lower Slopes	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.	**Absent** No permanent wetlands in study area.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.
Hirundapus caudacutus White-throated Needletail EPBC – V	This migratory terrestrial species occurs in Australia from late spring to early autumn. Found across a range of habitats more often over woodland areas, where it is almost exclusively aerial. Large tracts of native vegetation may be a key habitat requirement for this species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces	**Present** Some paddock trees and native vegetation patches are present in the study area	**Unlikely** Species was not detected during fauna surveys	**No** No suitable habitat would be impacted by the proposal.
Polytelis swainsonii Superb Parrot EPBC - V BC – V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. Inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	**Present** Box-Gum Woodland, River Red Gum Forest patches present in study area.	**Possible** Known records within 10 km of development site.	**Yes** AoS required

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
IBRA Sub-region: Inland Slopes, Lower Slopes				
Rostratula australis Australian Painted Snipe BC - E EPBC – E IBRA Sub-region: Inland Slopes, Lower Slopes	Little is known of the ecology, habitat requirements and reproductive biology of Australian Painted Snipe. They feed in shallow water or at the waters' edge and on mudflats, taking seeds and invertebrates such as insects, worms, molluscs and crustaceans. Females, which are larger and more brightly coloured than males, are thought to sometimes be polyandrous, mating with several males and leaving each one to incubate and raise chicks. Inhabits inland and coastal shallow freshwater wetlands. The species occurs in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation, including grasses, Lignum and Samphire. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland. Nests on the ground amongst tall vegetation, such as grass tussocks or reeds. Forages nocturnally on mud flats and in shallow water. Breeding is often in response to local conditions; generally, occurs from September to December.	**Absent** No mudflats in study area.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.
Grantiella picta *Painted Honeyeater* *BC – V* *EPBC – V* IBRA Sub-region: Inland Slopes, Lower Slopes	The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	**Present** Associated vegetation types of Box-Gum Woodland present in development sites	**Possible** Development site within known distribution	**Yes** AoS required

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Lathamus discolour Swift Parrot EPBC – CE IBRA Sub-region: Inland Slopes, Lower Slopes	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis* and Yellow Box *E. melliodiora* Return to home foraging sites on a cyclic basis depending on food availability.	**Present** Feed trees of Yellow Box present in development site	**Possible** Development site within known distribution. May forage in development site on occasion.	**Yes** AoS required
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew EPBC – CE	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The Eastern Curlew mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The Eastern Curlew roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands.	**Absent** Study area is not within coastal landforms.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.
Mammals				
Dasyurus maculatus maculatus (SE	Tiger Quolls are found in a range of forest habitats, from rainforest to open forest, coastal heath and inland riparian forest. They require forest with suitable den sites such as rock crevices, small caves, rocky-cliff faces. hollow logs,	**Absent** No forests, rock crevices, caves,	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
mainland population) Spotted-tailed Quoll BC - V EPBC – E IBRA Sub-region: Inland Slopes, Lower Slopes	burrows and tree hollows. The Tiger Quoll has a large home range and can cover considerable distances (more than 6km) overnight. It is largely nocturnal and solitary.	cliff faces in study area. Very few hollow logs.		impacted by the proposal.
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat EPBC – V BC - V IBRA Sub-region: Inland Slopes, Lower Slopes	Corben's Long-eared Bat occurs from the south eastern side of the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. The Species inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. The species roosts in tree hollows, crevices, and under loose bark, and breeds in autumn with one or two young born in late spring to early summer.	**Present** Hollow-bearing trees in study area.	**Possible** Study area within known distribution of species.	**Yes** AoS Undertaken
Pteropus poliocephalus Grey-headed Flying-fox	Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source, often in	**Absent** No riparian rainforest, gullies or vegetation with dense	**Unlikely** No breeding camps in development site. suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
EPBC – V IBRA Sub-region: Inland Slopes, lower slopes	stands of riparian rainforest, Paperbark or Casuarina forest, and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Forage on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia,* and fruits of rainforest trees and vines. Travel up to 50 km to forage. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century.	canopies, in study area.		
Phascolarctos cinereus *Koala* BC - V EPBC - V IBRA Sub-region: Inland Slopes, Lower Slopes	Occurs in eastern Australia, from north-eastern Queensland to south-eastern South Australia and to the west of the Great Dividing Range. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. The koala inhabits a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains.	**Present** Eucalypt Woodlands in study area.	**Possible** Suitable habitat present.	**No** See EPBC Koala habitat assessment
Amphibians				

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Litoria raniformis Southern Bell Frog EPBC –V BC – E IBRA Sub-region: Inland Slopes, Lower Slopes	Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Breeding occurs during the warmer months and is triggered by flooding or a significant rise in water levels. During the breeding season animals are found floating amongst aquatic vegetation (especially cumbungi or Common Reeds) within or at the edge of slow-moving streams, marshes, lagoons, lakes, farm dams and rice crops. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks.	**Absent** No aquatic vegetation in farm dams.	**Unlikely** No suitable habitat	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Crinia sloanei *Sloane's Froglet* EPBC- E	Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales. It has not been recorded recently in the northern part of its range and has only been recorded infrequently in the southern part of its range in NSW. At a number of sites where records are verified by museum specimens, the species has not been subsequently detected during more recent frog surveys in the vicinity (e.g. Holbrook, Nyngan, Wagga Wagga and Tocumwal). The low number of sites, low number of recorded individuals per site, and the low proportion of records of this species in regional surveys all indicate that a moderately low number of mature individuals exist. The apparent loss from previous recorded sites and decline in recording rates indicates that this is not just a rare or uncommonly encountered species, but that there has been a reduction in population size and range. It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats.	**Absent** No vegetated permanent waterbodies occurred in the development site	**Unlikely** Species was not detected during fauna surveys	**No** No suitable habitat would be impacted by the proposal.
Reptiles				
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard EPBC – V BC – V	Only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black	**Absent** No predominantly native grassy groundlayer or rocky outcrops in study area.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
IBRA Sub-region: Inland Slopes, Lower Slopes	ants and termites. Feeds on the larvae and eggs of the ants with which it shares its burrows. It is thought that this species lays 2 eggs inside the ant nests during summer; the young first appear in March. Best detected from September to February.			
Delma impar Striped Legless Lizard EPBC - V BC – V IBRA Sub-region: Inland Slopes	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo and Wallaby. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. Actively hunts for spiders, crickets, moth larvae and cockroaches. Animals have been recorded moving at least 20m in one day, and up to 50m over several weeks.	**Absent** No tussock grasslands or surface rocks in study area.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.
Fish				
Maccullochella peelii Murray Cod EPBC – V IBRA Sub-region: Inland Slopes	Grow up to a maximum size of 1200mm. Found extensively throughout the Murray Darling Basin in the south-eastern region of Australia. Murray cod are able to live in a wide range of habitats from clear, rocky streams in the upper western slopes regions of New South Wales to the slow flowing, turbid rivers and billabongs of the western plains. Generally, they are found in waters up to 5m deep and in sheltered areas with cover from rocks, timber or overhanging banks. The most common components of adult cod's diet include crustaceans such as yabbies, shrimp and crayfish, and fish such as the introduced common carp, goldfish and redfin perch, and the native fishes bony herring, catfish,	**Absent** No deep streams with shelter	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
	golden perch, western carp gudgeon and even other cod. It appears that Murray cod prefer protected spawning sites, and typically spawn large (3.0-3.5mm diameter) adhesive eggs onto firm substrates such as hollow logs, rocks, pipes and clay banks, from spring to early summer.			
Macquaria australasica Macquarie Perch EPBC – E IBRA Sub-region: Inland Slopes	Macquarie perch grow to a maximum size of 400mm. They are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. The conservation status of the different populations is not well known, but there have been long-term declines in their abundance. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries. They are quiet, furtive fish that feed on aquatic insects, crustaceans and molluscs. Sexual maturity occurs at two years for males and three years for females. Macquarie perch spawn in spring or summer in shallow upland streams or flowing parts of rivers. Females produce around 50,000-100,000 eggs which settle among stones and gravel of the stream or riverbed.	**Absent** No deep rocky holes with plenty of cover	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.
Flathead Galaxias *Galaxius rostratus* CE EPBC CE FM IBRA Sub-region: Inland Slopes	Below 150 m in altitude. Billabongs, lakes, swamps, and rivers, with preference for still or slow-flowing waters.	**Absent** Above 150 m in altitude.	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.
Migratory Species				

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Apus pacificus Fork-tailed Swift EPBC – M	This migratory marine species is a non-breeding visitor to Australia and has been recorded in all regions of NSW. Found across a range of habitats from inland open plains to wooded areas. They are mainly exclusively aerial flying from < 1m to 300 m above ground.	**Marginal** Aerial species. Minimal woodland within development site	**Possible** Study area within known distribution of species.	**Yes** AoS Required
Haliaeetus leucogaster White-bellied Sea Eagle EPBC - M	White-bellied Sea-Eagles are normally seen perched high in a tree or soaring over waterways and adjacent land. Birds form permanent pairs that inhabit territories throughout the year.	**Absent** No open waterways in the study area.	**Unlikely** No suitable habitat present.	**No** No suitable habitat would be impacted by the proposal.
Hirundapus caudacutus White- throated Needletail EPBC - V	White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. White-throated Needletails are non-breeding migrants in Australia.	**Marginal** Aerial species. Minimal woodland within development site	**Possible** Study area within known distribution of species.	**Yes** AoS Required
Myiagra cyanoleuca	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also	**Absent**	**Unlikely**	**No**

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Satin Flycatcher EPBC - M	found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. The Satin Flycatcher is a migratory species, moving northwards in winter to northern Queensland and Papua New Guinea, returning south to breed in spring.	No forests or gullies in study area.	No suitable habitat in study area.	No suitable habitat would be impacted by the proposal.
Rhipidura rufifrons Rufous Fantail EPBC - M	The Rufous Fantail is found in northern and eastern coastal Australia, being more common in the north. The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas. Strongly migratory in the south of its range, it moves northwards in winter, and virtually disappears from Victoria and New South Wales at this time.	**Absent** No wet forests, woodlands, mangroves or swamps in study area.	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.
Actitis hypoleucos Common Sandpiper EPBC - CE	This migratory wetland species is found along all Australian coastlines and many inland areas. They are active birds that will pursue invertebrates over rocks. Breeding habitat is mainly in Europe.	**Absent** No wetlands, mangroves or coastal landforms in study area.	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.
Calidris acuminate Sharp-tailed Sandpiper EPBC - M	This migratory wetland species wades mud in estuarine habitats feeding on invertebrates. They are widespread throughout much of NSW but are sparse in the south-central and lower western regions. Breeding habitat is in Northern Siberia.	**Absent** No mangroves or coastal landforms in study area.	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Calidris ferruginea Curlew Sandpiper EPBC - M	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.	**Marginal** Farm dams and ephemeral creek line in the study area.	**Possible** Study area within known distribution of species.	**No** Marginal habitat and unlikely to occur.
Calidris melanotos Pectoral Sandpiper EPBC - M	This species breeds in high-arctic tundra from the Yamal Peninsula eastwards to the Bearing Strait in Siberia and in arctic Alaska and Canada. It is known to migrate mostly through the USA and Mexico and spends most of its non-breeding months in South America. A small number of these birds are known to reach Australia and are believed to be concentrated in south-eastern Australia. This species prefers freshwater mudflats.	**Absent** No freshwater mudflats in study area.	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.
Gallinago hardwickii Latham's Snipe, Japanese Snipe EPBC - M	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. Latham's Snipe does not breed within Australia.	**Absent** No wetlands in study area.	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew EPBC – M	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The Eastern Curlew mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The Eastern Curlew roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands.	**Absent** No coastal landforms, mangroves or wetlands in the study area.	**Unlikely** No suitable habitat in study area.	**No** No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
CE BC = listed as Critically Endangered under Schedule 1 of the NSW *Biodiversity Conservation Act 2016* CE EPBC = listed as Critically Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.* E BC = listed as Endangered under Schedule 1 of the NSW *Biodiversity Conservation Act 2016* E EPBC = listed as Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.* V BC = listed as Vulnerable under Schedule 1 of the NSW *Biodiversity Conservation Act 2016* V EPBC = listed as Vulnerable under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.* M EPBC = listed as Migratory under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.* CE FM = listed as Critically Endangered under Schedule 4A of the NSW *Fisheries Management Act 1994.* E FM = listed as Endangered under Schedule 4 of the NSW *Fisheries Management Act 1994.* V FM = listed as Vulnerable under Schedule 5 of the NSW *Fisheries Management Act 1994.*		CAMBA = Chinese-Australia Migratory Bird Agreement JAMBA = Japan-Australia Migratory Bird Agreement		

APPENDIX F EPBC ASSESSMENT OF SIGNIFICANT IMPACT

F.1 FLORA SPECIES

The *Environment Protection and Biodiversity Conservation Act* 1999 specifies factors to be taken into account in deciding whether a development is likely to significantly affect EECs, threatened species and migratory species, listed at the Commonwealth level. The following assessments assesses the significance of the likely impacts associated with the proposed works on:

Critically Endangered Species

Swift Parrot – (*Lathamus discolor*) -CE

Regent Honeyeater (*Anthochaera phrygia*) -CE

Endangered species

Small Purple-pea - E

Vulnerable Species

Superb Parrot (*Polytelis swainsonii*) **-** V

Painted Honeyeater (*Grantiella picta*)- V

Corben's Long-eared Bat (*Nyctophilus corbeni*) – V

White-throated Needletail (*Hirundapus caudacutus*) - V

Migratory Species

Fork-tailed Swift (*Apus pacificus*) - M

White-throated Needletail (*Hirundapus caudacutus*) - M

Table 0-1 Assessment of Significance for critically endangered EPBC species

Critically Endangered Species (Swift Parrot and Regent Honeyeater)
a) Will the action lead to a long-term decrease in the size of a population of a species?
Swift Parrot
Swift Parrots can forage in lerp infested Grey Box and Yellow Box trees. Potential foraging habitat for Swift Parrots occurs within the development site and would be removed by the proposal. Surveys did not detect these species and no known records occur within the development site. The development site is not considered known habitat but provides potential foraging habitat. The proposal would involve the removal of around 0.61 ha of Box Gum Woodland. There would also be some disturbance associated with construction, including noise, vibration, light. The quality of potential habitat for these species is low, being largely cleared and highly disturbed by agriculture. Given the relatively small amount of habitat to be removed, and with the recommended mitigation measures, the likelihood of the proposal leading to a long-term decrease in the size of a population of this species is minimal.
Regent Honeyeater
The Regent Honeyeater is considered to occur as a single population throughout its range. No known records occur with the development site and they were not detected during the site surveys. The development site is not considered known habitat but provides potential foraging habitat. The proposal would involve the removal of around 0.61 ha of Box Gum Woodland. There would also be some disturbance associated with construction, including noise, vibration, light. The quality of potential habitat for these species is low, being largely cleared and highly disturbed by agriculture. Given the relatively small amount of habitat to be removed, and with the recommended mitigation measures, the likelihood of the proposal leading to a long-term decrease in the size of a population of this species is minimal.
b) Will the action reduce the area of occupancy of the species?
Swift Parrot
The proposal would involve the removal of around 0.61 ha of potential foraging habitat. There would also be some disturbance associated with construction. The development site is not considered known habitat. The quality of habitat in the development site is low, being highly fragmented and partially cleared from agriculture and the area of habitat to be removed is relatively small in the context of the Swift Parrots range across South Eastern Australia. In this context, while removal of this habitat could reduce the area of occupancy, it would not be enough to have a significant impact on these species.
Regent Honeyeater
The proposal would involve the removal of around 0.61 ha of potential foraging habitat. There would also be some disturbance associated with construction. The development site is not considered known habitat. The quality of habitat in the development site is low, being highly fragmented and partially cleared from agriculture and the area of habitat to be removed is relatively small in the context of the Swift Parrots range across South Eastern Australia. In this context, while removal of this habitat could reduce the area of occupancy, it would not be enough to have a significant impact on these species.
c) Will the action fragment an existing population into two or more populations?
Swift Parrot

The Swift Parrot occurs as a single migratory population (Saunders & Tzaros, 2011) The proposal would involve the removal of around 0.61 ha of potential habitat. There would also be some disturbance associated with construction. The development site is not considered known habitat.

The area of habitat to be removed is relatively small in the context of the Swift Parrots range across South-Eastern Australia and would not disrupt habitat connectivity for the migratory Swift Parrot. 62 ha of remnant vegetation would still remain within or adjacent to the development site and migratory movement would not be impacted. The proposal would not fragment an existing population of this species into two or more populations.

Regent Honeyeater

The Regent honeyeater population comprises a single population that moves throughout its range of South Eastern Australia. The proposal would involve the removal of around 0.61 ha of potential habitat. There would also be some disturbance associated with construction.

The area of habitat to be removed is relatively small in the context of the Regent Honeyeaters range across South-Eastern Australia and would not disrupt habitat connectivity for the Regent Honeyeater. 62 ha of remnant vegetation would still remain within or adjacent to the development site and movement would not be impacted. The proposal would not fragment an existing population of this species into two or more populations.

d) Will the action adversely affect habitat critical to the survival of a species?

Swift Parrot

Habitat critical to the survival of the Swift Parrot includes those areas of priority habitat for which the Swift Parrot has a level of site fidelity or are identified by the recovery team. The development site is not known habitat nor within a mapped important area identified by OEH and is unlikely to be habitat critical to the survival of the species.

Regent Honeyeater

Critical habitat for the survival of the Regent Honeyeater listed in the national recovery plan includes

- any breeding or foraging habitat where the species is likely to occur (as defined by the distribution map)
- Any newly discovered breeding or foraging locations

The development site falls within the mapped areas of where this species is likely to occur but not within a key breeding area. 0.61 ha of habitat would be removed. However, this vegetation is of low habitat quality comprised of smaller isolated patches within a cleared and disturbed agricultural landscape and road reserves.

e) Will the action disrupt the breeding cycle of the species?

Swift Parrot

Swift Parrots breed only in Tasmania, migrating to the mainland in autumn and winter. The likelihood of the action disrupting the breeding cycle of a population of these species is minimal.

Regent Honeyeater

Four key breeding areas occur in the known range of the Regent Honeyeater. The development site is not within a known breeding area for the Regent Honeyeater; thus the proposal is unlikely to disrupt the breeding cycle of the species.

f) Will the action modify, destroy, remove, isolate or decrease the availability of quality habitat to the extent that the species is likely to decline?

Swift Parrot

The proposal would involve the removal of around 0.61 ha of foraging habitat. There would also be some disturbance associated with construction, which could decrease the quality of some habitat in the short-term. The development site is not considered known habitat and is considered potential foraging habitat only.

The area of habitat to be removed is relatively small in the context of the Swift Parrots range across South-Eastern Australia and would not disrupt habitat connectivity. Approximately 63ha of similar or better-quality habitat would remain within or adjacent to the development site. With the implementation of the recommended mitigation measures, the likelihood of the action modifying, destroying, removing, isolating, or decreasing the availability or quality of habitat to the extent that these species would be likely to decline is minimal.

Regent Honeyeater

The proposal would involve the removal of around 0.61 ha of foraging habitat, comprised of smaller isolated patches and road reserves. This habitat is considered low quality having been partially cleared and degraded from intense agricultural activities. There would also be some disturbance associated with construction, which could decrease the quality of some habitat in the short-term. The development site is not considered known habitat and is considered potential foraging habitat only.

While the proposal may reduce the availability of habitat, this habitat is considered low quality. 63ha of similar or better-quality habitat would remain within or adjacent to the development site that could provide foraging habitat for the Regent Honeyeater. The likelihood of the action modifying, destroying, removing, isolating, or decreasing the availability or quality of habitat to the extent that these species would be likely to decline is minimal.

g) Will the action result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat?

Swift Parrot and Regent Honeyeater

The proposal will modify the current land use, potentially creating additional shelter habitat for predatory invasive species such as foxes and cats, which are considered likely to be locally prevalent regardless of the proposal. Management protocols will be prepared and implemented as part of the Flora and Fauna Management Plan for the proposal which will monitor and manage these species within the development site. These species are already widespread in a rural environment and the proposal is not anticipated to increase the numbers of feral pest animals.

There is a risk that invasive weed could be introduced to the proposal area via machinery, vehicles, and materials during construction. With the implementation of the recommended mitigation measures, including restricting vehicle movements to sealed tracks, the likelihood of the action resulting in harmful invasive species becoming established in the vulnerable species' habitat is minimal.

h) Will the action introduce disease that may cause the species to decline?

Swift Parrot

Beak and Feather Disease could impact the Swift Parrot; however, the proposal is not considered likely to act as a vector for the disease. With the implementation of the recommended mitigation measures, the likelihood of the action resulting in the introduction of diseases that may cause the species to decline is minimal.

Regent Honeyeater

The proposal is not considered to act as a vector for any diseases to the Regent Honeyeater.

i) Will the action interfere substantially with the recovery of the species?

Swift Parrot

The National Recovery Plan for the Swift Parrot lists the following objectives:

1. To identify and prioritise habitats and sites used by the species across its range, on all land tenures.
2. To implement management strategies to protect and improve habitats and sites on all land tenures.
3. To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD).
4. To monitor population trends and distribution throughout the range.

The proposal would not interfere with any of these objectives.

Regent Honeyeater

The National Recovery Plan for the Regent Honeyeater lists the following objectives;

1. Reverse the long-term population trend to decline and increase the number of regent honeyeaters to a level where there is a viable, wild breeding population even in poor breeding years
2. Enhance the condition of habitat across the regent honeyeater ranges to maximise survival and reproductive success and provide refugia during periods of extreme environmental fluctuation

The proposal would not substantially interfere with any of these objectives.

Conclusion

A significant impact to these species is considered unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

A referral to the Federal Department of Environment is not considered necessary.

Table 0-2 Assessment of Significance for endangered EPBC species

Endangered Species (Small Purple-pea)
a) Will the action lead to a long-term decrease in the size of a population of a species?
Small Purple-pea
Occurs in grassland and open woodland, often on stony hillsides, dominated by one or more of the following: Callitris endichleri, C. glaucophylla, Eucalyptus blakelyi, E. bridgesiana, E. dives, E. melliodora, E. microcarpa, E. nortonii and E. polyanthemos. Requires a forb-rich grassy groundlayer dominated by Themeda triandra, Poa sieberiana var. sieberiana or Austrostipa spp. Resprouts in autumn and winter from a woody root. It flowers in spring, peaking over two to three weeks in October. Although we have assumed its presence in the development footprint, of up to 0.1 ha of low-quality potential habitat will be impacted by the development which is unlikely to lead to a long-term decrease in the size of the population.
b) Will the action reduce the area of occupancy of the species?
Small Purple-pea
The proposal would involve the removal of up to 0.1 ha of Box Gum Woodland with limited native understory, potential habitat for the Small Purple-pea. There may also be some disturbance associated with construction activities. As the quality of the habitat is low in comparison to the retained vegetation of the development site and the adjacent vegetation, the removal of this habitat may slightly reduce the area of occupancy, although it would not be enough to have a significant impact on these species.
c) Will the action fragment an existing population into two or more populations?
Small Purple-pea
The proposal would involve the removal of up to 0.1 ha of Box Gum Woodland with limited native understory, potential habitat for the Small Purple-pea This vegetation is part of a larger contiguous patch of Box Gum Woodland. The vegetation is of lower quality compared to the connected retained vegetation within the development site and in adjacent areas. The removal of this vegetation will not fragment the existing population.
d) Will the action adversely affect habitat critical to the survival of a species?
Small Purple-pea
There are historical records around Wagga Wagga and within Culcairn where it is considered now extinct by OEH. As the quality of the habitat being removed is low in comparison to the retained vegetation of the development site and the adjacent vegetation, the removal of this habitat would unlikely be critical to the survival of the species within the landscape.
e) Will the action disrupt the breeding cycle of the species?
Small Purple-pea
Impacts as a result of the development are restricted to low condition vegetation with an already disturbed ground layer. Any disruption to the breeding cycle of the species will be restricted to a small patch which will not affect the breeding cycles of known populations in the region.

f) Will the action modify, destroy, remove, isolate or decrease the availability of quality habitat to the extent that the species is likely to decline?
Small Purple-pea
The proposal would involve the removal of up to 0.1 ha of low-quality potential habitat. The action will not modify, destroy, remove, isolate or decrease the availability of quality habitat to the extent that the species is likely to decline.
g) Will the action result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat?
Small Purple-pea
There is a risk that invasive weed could be introduced to the proposal area via machinery, vehicles, and materials during construction. With the implementation of the recommended mitigation measures, including restricting vehicle movements to sealed tracks, the likelihood of the action resulting in harmful invasive species becoming established in the species' habitat is minimal.
h) Will the action introduce disease that may cause the species to decline?
Small Purple-pea
With the implementation of the recommended mitigation measures, the likelihood of the action resulting in the introduction of diseases that may cause the species to decline is minimal.
i) Will the action interfere substantially with the recovery of the species?
Small Purple-pea
The Saving our Species strategy lists 3 key management sites for this species (Mount Arthur, Tralee-Williamsdale Railway easement, Williamsdale), none of which are within the development site or the broader region. As such, the proposal would not interfere with any of these key management sites.
Conclusion
A significant impact to these species is considered unlikely, on the basis that the proposal would not: • Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population • Affect habitat critical to the survival of these species • Affect habitat or introduce disease such that these species would decline • Introduce invasive species harmful to the species • Interfere with the recovery of these species. A referral to the Federal Department of Environment is not considered necessary.

Table 0-3 Assessment of Significance for Vulnerable EPBC species

Vulnerable Species (Superb Parrot & Painted Honeyeater)
a) Will the action lead to a long-term decrease in the size of an important population of a species?
Superb Parrot

No records of the Superb Parrot occur within the development site and no known population of Superb Parrot occurs within the development site. The development site is not considered known habitat but provides potential foraging habitat. The breeding population of Superb Parrots *Polytelis swainsonii* is approximately 6500. The species is somewhat mobile, and typically utilises foraging habitat within 10km of breeding habitat (SPRAT, 2017).

The development site is not part of a core breeding area for the Superb Parrot (Baker Gabb, 2011). Thus, an important population is not considered to occur in the development site and no impacts are anticipated to an important population of Superb Parrot.

Painted Honeyeater

No records of the Painted Honeyeater occur within the development site and no known population occurs within the development site. The mistletoe which provides foraging and breeding habitat is also absent in the development site. The development site is not part of a key management site listed by OEH, thus an important population is not considered to occur in the development site and no impacts are anticipated to an important population of Painted Honeyeater.

Corben's Long-eared Bat

No records of the Corben's Long-eared Bat occur within the development site and no known population of Corben's Long-eared Bat occurs within the development site. The presence of Box-Gum Woodland and hollow bearing trees provides potential foraging and roosting habitat for this species. The development site is not part of a key management site listed by OEH, thus an important population is not considered to occur in the development site and no impacts are anticipated to an important population of Corben's Long-eared Bat.

White-throated Needletail

No records of the White-throated Needletail occur within the development site and no known population of White-throated Needletail occurs within the development site. The development site is not considered known habitat but provides potential foraging habitat. The subspecies c*audacutus* is the key breeding population that affects the Needletails that occur in Australia (SPRAT, 2019). However, this subspecies *caudacutus* only breeds outside of Australia, thus an important population is not considered to occur in the development site and no impacts are anticipated to an important population of White-throated Needletail.

b) Will the action reduce the area of occupancy of an important population of the species?

Superb Parrot

As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of breeding and foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.

Painted Honeyeater

As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of breeding and foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.

Corben's Long-eared Bat
As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of roosting and foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.
White-throated Needletail
As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.
c) Will the action fragment an existing important population into two or more populations?
Superb Parrot
As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile, the proposal will not impact on its movement within or across the development site.
Painted Honeyeater
As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile, the proposal will not impact on its movement within or across the development site.
Corben's Long-eared Bat
As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile, the proposal will not impact on its movement within or across the development site.
White-throated Needletail
As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile and predominately aerial, the proposal will not impact on its movement within or across the development site.
d) Will the action adversely affect habitat critical to the survival of a species?
Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail
The Register of Critical Habitat established under the EPBC Act does not list any critical habitat for these protected species. The proposed development is not located near any critical habitat for and species listed on the register.
e) Will the action disrupt the breeding cycle of an important population of the species?

Superb Parrot
No known important population occurs within the proposal area. Three main breeding areas for the superb parrot occur in NSW. The nearest known breeding area to the proposal area occurs in the South West Slopes near Wagga Wagga, around 100km north of Walla Walla (Baker Gabb, 2011). Within the South West Slopes, the Superb Parrot breeds in hollows in River Red Gum, Blakely's Red Gum, Apple Box, Grey Box, White Box and Red Box species. The nests are usually located near water and the same nest hollows are used in successive years. The action would not disrupt the breeding cycle of an important population.
Painted Honeyeater
No known important populations occur within the proposal area.
Corben's Long-eared Bat
No known important population occurs within the proposal area.
White-throated Needletail
This species does not breed in Australia.
f) Will the action modify, destroy, remove, isolate or decrease the availability of quality habitat to the extent that the species is likely to decline?
Superb Parrot
The proposal will remove approximately 0.60 ha of woodland vegetation in the development site. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.
Painted Honeyeater
The proposal will remove approximately 0.60 ha of woodland vegetation in the development site. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.
Corben's Long-eared Bat
The proposal will remove approximately 0.60 ha of woodland vegetation in the development site, and 71 hollow bearing trees. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.
White-throated Needletail

The proposal will remove approximately 0.60 ha of woodland vegetation in the development site. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.

g) Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail

The proposal is not considered likely to result in invasive species becoming established within the Superb Parrot's habitat. Competition with Noisy Miners for breeding and foraging habitat and resources is a major threat to the species and cause for the decline in population numbers. Noisy Miners are already present at the development site. The proposal is unlikely to result in invasive species such as these that are harmful to the habitat of the Superb Parrot.

The proposal will modify the current land use, potentially creating additional shelter habitat for predatory invasive species such as foxes and cats, which are considered likely to be locally prevalent regardless of the proposal. Management protocols will be prepared and implemented as part of the Flora and Fauna Management Plan for the proposal which will monitor and manage these species within the development site.

h) Will the action introduce disease that may cause the species to decline?

Superb Parrot

Beak and Feather Disease has been proven to impact the Superb Parrot (DoE, 2017), however the proposal is not considered likely to act as a vector for the disease.

Painted Honeyeater

The proposal is not considered to act as a vector for any diseases to the Painted Honeyeater.

Corben's Long-eared Bat

The proposal is not considered to act as a vector for any diseases to the Corben's Long-eared Bat.

White-throated Needletail

The proposal is not considered to act as a vector for any diseases to the White-throated Needletail.

i) Will the action interfere substantially with the recovery of the species?

Superb Parrot

Core breeding areas and surrounding habitat are considered important to the recovery of the species. The nearest known breeding area to the proposal area occurs in the South West Slopes near Wagga Wagga, approximately 100km north of the development site. Habitats across the broader proposal area will remain available to the species and given its mobility, the proposal would not restrict the movements of the species across the development site. The proposal is unlikely to interfere with the recovery of the Superb Parrot.

Painted Honeyeater
No recovery plan has been developed for the Painted Honeyeater.
Corben's Long-eared Bat
No recovery plan has been developed for the Corben's Long-eared Bat.
White-throated Needletail
No recovery plan has been developed for the White-throated Needletail

Conclusion

A significant impact to this species is considered unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of an important population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

A referral to the Federal Department of Environment is not considered necessary.

Migratory Species (Fork-tailed Swift and White-throated needletail)

An assessment of significance for migratory species must establish whether the habitat on the proposed site is considered "important habitat" as defined in the EPBC Act.

"Important habitat" for migratory species is described as:

1. Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
2. Habitat that is of critical importance to the species at particular life-cycle stages; and/or
3. Habitat utilised by a migratory species which is at the limit of the species range; and/or
4. Habitat within an area where the species is declining.

The habitat within the proposal site is not considered important habitat for the Fork-tailed Swift or the White-throated Needletail.

a) Will the action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles, or altering hydrological cycles), destroy, or isolate an area of important habitat for a migratory species?

Fork-tailed Swift & White-throated Needletail

The Fork-tailed Swift and the White-throated Needletail are almost exclusively aerial and are considered unlikely to rely on the habitats present within the proposal site. The habitats within the proposal site are not considered important habitat. Therefore, the action is unlikely to substantially modify, destroy or isolate an area of important habitat for either species.

b) Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?

Fork-tailed Swift & White-throated Needletail

The Fork-tailed Swift and the White-throated Needletail are almost exclusively aerial and are considered unlikely to rely on the habitats present within the proposal site. The habitats within the proposal site are not considered important habitat. Therefore, the action is unlikely to substantially modify, destroy or isolate an area of important habitat for either species.

c) Will the action seriously disrupt the lifecycle (breeding, feeding, migration, or resting behaviour) of an ecologically significant proportion of the population of a migratory species?

Fork-tailed Swift & White-throated Needletail

The Fork-tailed Swift and the White-throated Needletail are almost exclusively aerial and are considered unlikely to rely on the habitats present within the proposal site. The area is not considered to support an ecologically significant proportion of the population of the species. Therefore, the action is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of either species.

Conclusion

The project site area contains habitat that could potentially be used by the Fork-tailed Swift or the White-throated Needletail. Of the four criteria for significant impact for a migratory species, the project is unlikely to cause a significant impact to any criteria. The proposal is therefore considered unlikely to significantly impact the Fork-tailed Swift or the White-throated Needletail.

APPENDIX G BAM CALCULATOR CREDIT REPORT

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00017027/BAAS18074/19/00017029	Culcairn Solar Farm	30/10/2019
Assessor Name	Report Created	BAM Data version *
	07/11/2019	16
Assessor Number	BAM Case Status	Date Finalised
	Finalised	07/11/2019
Assessment Revision	Assessment Type	
1	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion								
1	277_Exotic_Understory	32.3	0.6	0.25	High Sensitivity to Potential Gain	2.00	TRUE	10

2	277_Native_Understory	48.1	0.0	0.25	High Sensitivity to Potential Gain	2.00	TRUE	1
3	277_Derived_Grassland	26.0	0.0	0.25	High Sensitivity to Potential Gain	2.00	TRUE	1
							Subtotal	**12**
							Total	**12**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Cullen parvum / Small Scurf-pea (Flora)						
277_Exotic_Understory	32.3	0.59	0.25	2	False	10
277_Native_Understory	48.1	0.01	0.25	2	False	0
277_Derived_Grassland	26.0	0.01	0.25	2	False	0
					Subtotal	**10**
Swainsona recta / Small Purple-pea (Flora)						
277_Exotic_Understory	32.3	0.59	0.25	2	False	10
277_Native_Understory	48.1	0.01	0.25	2	False	0
277_Derived_Grassland	26.0	0.01	0.25	2	False	0
					Subtotal	**10**
Swainsona sericea / Silky Swainson-pea (Flora)						
277_Exotic_Understory	32.3	0.59	0.25	2	False	10

277_Native_Understory	48.1	0.01	0.25	2	False	0
277_Derived_Grassland	26.0	0.01	0.25	2	False	0
					Subtotal	**10**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00017027/BAAS18074/19/00017029	Proposal Name Culcairn Solar Farm	BAM data last updated * 30/10/2019
Assessor Name	Assessor Number	BAM Data version * 16
Proponent Names Neoen	Report Created 07/11/2019	BAM Case Status Finalised
Assessment Revision 1	Assessment Type Major Projects	Date Finalised 07/11/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	0.6	12.00

277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	White Box Yellow Box Blakely's Red Gum Woodland This includes PCT's: 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698	-	Yes	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Cullen parvum / Small Scurf-pea	0.6	10.00
Swainsona recta / Small Purple-pea	0.6	10.00

Swainsona sericea / Silky Swainson-pea	0.6	10.00

Cullen parvum/ Small Scurf-pea	277_Derived_Grassland	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cullen parvum/Small Scurf-pea	Any in NSW
	277_Exotic_Understory	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cullen parvum/Small Scurf-pea	Any in NSW
	277_Native_Understory	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cullen parvum/Small Scurf-pea	Any in NSW

Swainsona recta/ Small Purple-pea	277_Derived_Grassland	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Swainsona recta/Small Purple-pea	Any in NSW
	277_Exotic_Understory	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Swainsona recta/Small Purple-pea	Any in NSW
	277_Native_Understory	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Swainsona recta/Small Purple-pea	Any in NSW
Swainsona sericea/ Silky Swainson-pea	277_Derived_Grassland	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Swainsona sericea/Silky Swainson-pea	Any in NSW
	277_Exotic_Understory	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Swainsona sericea/Silky Swainson-pea	Any in NSW
	277_Native_Understory	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Swainsona sericea/Silky Swainson-pea	Any in NSW

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00017027/BAAS18074/19/00017028	Culcairn Solar Farm_paddocktrees	30/10/2019
Assessor Name	Report Created	BAM Data version *
	07/11/2019	16
Assessor Number	BAM Case Status	Date Finalised
	Finalised	07/11/2019
Assessment Revision	Assessment Type	
2	Paddock Trees	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Paddock Trees Credit Requirement

Class	Contains hollows	Number of trees	Ecosystem credits
277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion			
3	True	6.0	6
3	True	42.0	42
3	False	12.0	9
3	True	1.0	1
3	True	2.0	2
3	False	1.0	1
3	True	7.0	7
3	False	5.0	4
3	False	3.0	2
			74
76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions			
3	True	13.0	13
3	False	7.0	5
			18
			92

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00017027/BAAS18074/19/00017028

Proposal Name
Culcairn Solar Farm_paddocktrees

BAM data last updated *
30/10/2019

Assessor Name

Assessor Number

BAM Data version *
16

Proponent Names

Report Created
07/11/2019

Date Finalised
07/11/2019

Assessment Revision
2

Assessment Type
Paddock Trees

BAM Case Status
Finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

BAM Biodiversity Credit Report (Like for like)

Ecosystem Credit Summary

PCT	TEC	Credits
277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	74.00
76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	18.00

Credit classes for 76	**Like-for-like options**			
	TEC	Trading group	HBT	IBRA region
	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	-	Yes	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Credit classes for 277	**Like-for-like options**			
	TEC	Trading group	HBT	IBRA region

	White Box Yellow Box Blakely's Red Gum Woodland	-	Yes	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.